IOWATER

Volunteer Water Quality Monitoring

STATUS REPORT 2003

Iowa Department of Natural Resources
Jeffrey R. Vonk, Director

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Thank You!

Volunteerism is the epitome of selfless service. Volunteers dedicate their time and service, quietly and without applause, thanklessly, unselfishly, and generously, satisfied and proud of the job they've done and of the goals they've accomplished. For that unparalleled dedication, IOWATER would like to extend a sincere, heartfelt "Thank You" to each and every one of Iowa's volunteers. Your contributions to the betterment of our state shall remain with your legacy.

This status report reflects the hard work of volunteers who collect water quality data, and is our effort to summarize what we've learned through your monitoring.

INTRODUCTION

The idea for a statewide volunteer citizen water monitoring program for Iowa surfaced in 1998. Growing concerns over water quality issues led to a cooperative effort among the Iowa Department of Natural Resources, Iowa Division of the Izaak Walton League, Iowa Environmental Council, Iowa Farm Bureau, Natural Resources Conservation Service, and the University of Iowa Hygienic Laboratory to focus on protecting and improving Iowa's water quality by establishing and supporting a statewide volunteer water monitoring program. This original partnership sparked the creation and evolution of the program known today as IOWATER.

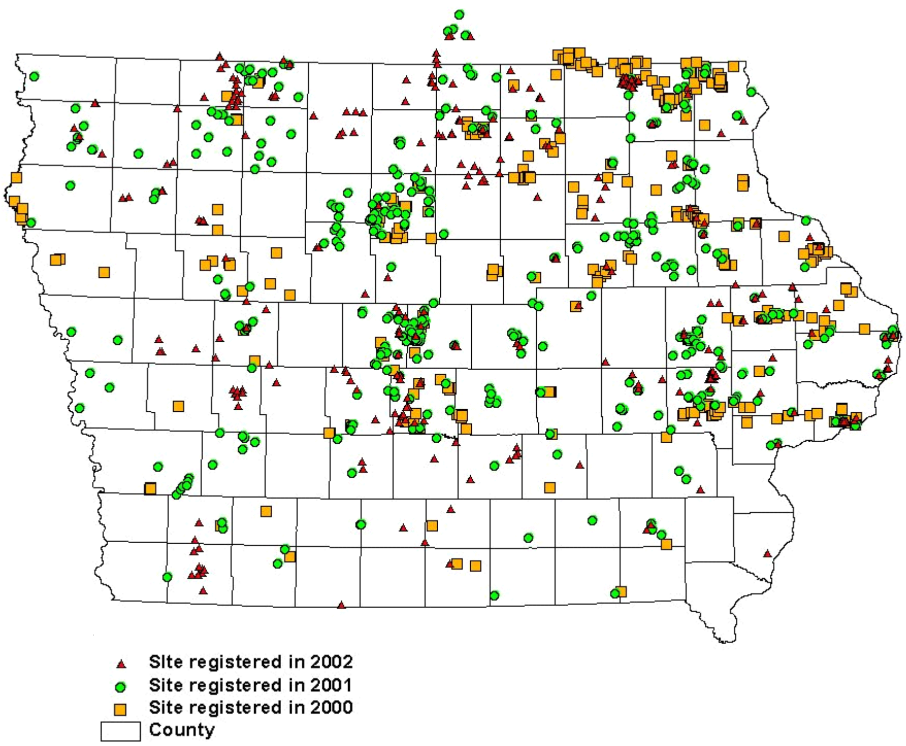


Figure 1. *IOWATER sites registered by year.*

IOWATER Tenets

The foundation of IOWATER is rooted in its guiding tenets, which are as follows:

Citizen-based – The citizens of Iowa make up the IOWATER program; without them, IOWATER would cease to exist. They not only monitor their local water bodies, but they also provide input and direction for the program. IOWATER as a program is just merely the conduit through which Iowans can make a difference.

Focuses on Solutions, Not Problems – The more monitors there are in the field, the more water quality problems will likely be discovered. However, the intent of the program isn't to go out in mass to locate problems. Rather, it is to gather data that can be used to establish a baseline assessment of Iowa's waters and raise awareness about the importance of water quality. If problems are discovered, solutions to them should be developed as a collaborative effort amongst everyone involved.

Seeks Results, Not Regulation – IOWATER is not regulatory. Solutions to problems that may be encountered are encouraged to be developed locally, with all stakeholders working together to achieve results.

Flexible – There are very few people generous enough to devote time volunteering in their communities. Fortunately, these people contribute unselfishly, oftentimes without receiving adequate recognition for their services. In order for a volunteer program to be successful, it must complement the schedules and goals of its constituents. Therefore, IOWATER not only allows its volunteers to develop their own monitoring regimes, it also allows them to participate whenever and wherever it is most convenient for them.

Partnership Formation – Water quality is an issue that affects each and every Iowan. In order to formulate solutions and achieve results, everyone must work together towards a common goal (to protect and improve Iowa's water quality). After all, everyone, everywhere lives in a watershed.

Emphasizes the Watershed Approach – A body of water will only be as healthy as the watershed that surrounds it. Therefore, in order to protect and improve Iowa's water quality, primary care must be given not only to the water bodies themselves, but also to the landscapes surrounding them.

Keys To Success

Ultimately, the success and sustainability of the IOWATER program rests in the hands of its dedicated, hard-working volunteers. Fortunately, the early founders of the program had the foresight, knowledge, and ambition to establish and implement a well-structured plan that allows the volunteers to mold the program to suit their needs. This plan included the following principles:

Form Partnerships – IOWATER's keys to success may be attributed to many different things. The cornerstone of this success lies in the partnerships that were formed with existing water monitoring efforts before the creation of the program. These early pioneer programs provided valuable information and helped drum up citizen support for IOWATER. Many of these early programs continue to exist today. Partnerships are not about conforming and obscuring identity; they are about working together for the common good. IOWATER certainly extends its special thanks and gratitude for their efforts and priceless contributions. Partnership acquisition is an on-going, proactive process that will continue throughout the future of the program. The people associated with these alliances are encouraged take an active role on the IOWATER Committee. This committee provides structure and direction that help guide the program and initiate action.

Table 1. *2000-2002 IOWATER Numbers.*

Level 1 Certified Monitors	1,465
Level 2 Certified Monitors*	126
Registered Sites	1,074
Chem/Phys Assessment Data Sets	3,440
Habitat Assessment Data Sets	946
Biological Assessment Data Sets	1,267

* Monitors who have attended Level 1 and 2 workshops and one module

On-site Training – The use of on-site training has contributed to the unbridled growth of the IOWATER program in the past few years. The decision to diversify and reorganize from centralized, Springbrook Conservation Education Center-based workshops to on-site workshops have opened the water monitoring market to all Iowans – not just to those in close proximity to Springbrook.

Provide Testing Equipment – The phrase "If you build it, they will come," achieved infamy in 1989 with the shockingly popular movie, Field of Dreams. A decade later, IOWATER adopted the idea of "If you supply them with water monitoring equipment, they will monitor." This unconventional approach to volunteer programming has been well-received and embraced by those involved. Unfortunately, not everyone who attends a workshop carries through with using the equipment. However, if none of the participants were given equipment, IOWATER may not have any water monitors at all. This arrangement has played a major role in the success of the program.

Provide Support Materials – IOWATER manuals supplement the workshops and are to be used as reference guides. They provide volunteers with background information, "How-To" information for stream monitoring, writing press releases, communicating with the public, etc., and contain detailed information about the monitoring parameters. In addition to manuals, volunteers are also presented with the Adopt-A-Stream Foundation's book, Streamkeeper's Field Guide, which provides a more in-depth look at water monitoring.

Provide Technical Assistance – Full-time IOWATER staff are readily available to assist not only IOWATER volunteers, but also any other persons interested in water quality. Furthermore, the official IOWATER newsletter is published quarterly and highlights volunteer actions, program updates, special events, and many other water quality related articles.

Online Database – The crown jewel of the IOWATER program lies in

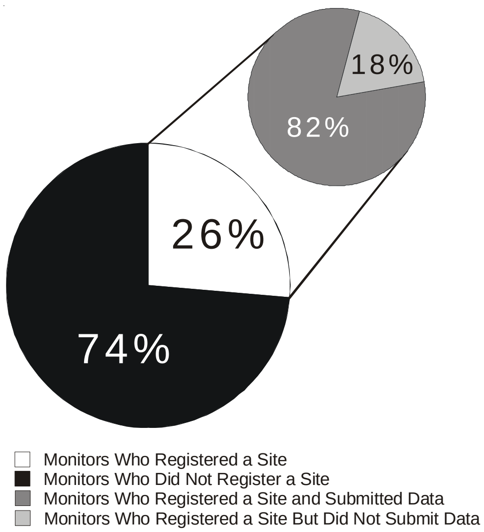


Figure 2. *During 2000-2002, roughly 26% of monitors registered a site; 82% submitted data.*

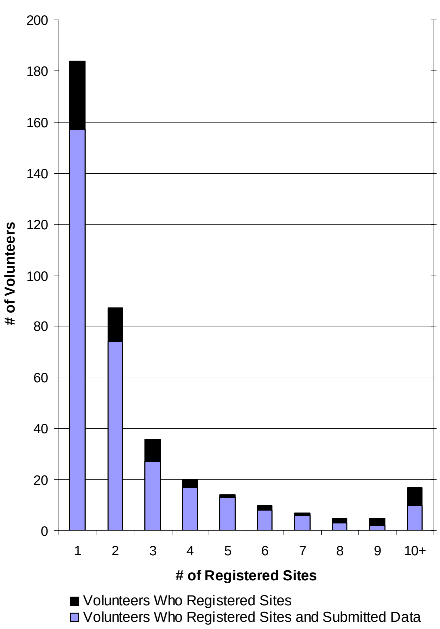


Figure 3. *Volunteers can register multiple monitoring sites.*

its online database. This component of the program really sets it apart from many of the other existing water quality programs. Although not everyone has access to the internet and not all internet access is created equally, IOWATER's online database application has experienced tremendous success. This process eliminates the accumulation of paper datasheets and not only empowers the volunteers to submit their own data, but also allows anyone with internet access the ability to view and utilize the data.

IOWATER Numbers

The first IOWATER workshop was held in August 1999 at the Springbrook Conservation Education Center and its overwhelming success led to another in October of the same year. Since then, more than 55 Level 1 workshops have been conducted throughout Iowa. Furthermore, IOWATER Level 2 workshops and associated modules have been developed and presented as well. The shear numbers of trained volunteers attest to the importance of water quality issues and the emphasis that the citizens of Iowa put on them.

As seen in Table 1, nearly 1,500 volunteers have been trained at Level 1 workshops since 2000. From 2000 to 2002, 26%, or 387 Level 1 certified volunteers registered 1,073 monitoring sites on the database. Of those, 82%, or 317 monitors submitted at least one dataset for the site they registered. Eighteen percent, or 70 monitors, did not submit any data – they only registered sites (Figure 2). These figures do not consider those who monitor but do not submit data, nor those who monitor in groups or teams.

Quite a few of the 387 volunteers registered multiple sites. Most IOWATER volunteers only register for one or two sites, but there are those who registered as many as 30 (Figure 3).

In 2000, the 18 IOWATER Level 1 Workshops (Figure 4) had a total attendance of 553 volunteers. Between 2000 and 2002, 199, or 36% of these monitors registered sites (Figure 5).

In 2001, 558 new IOWATER volunteers were trained at 21 Level 1 workshops. The percent of volunteers who registered sites, however, dropped from 36% to 21%. A total of 117 monitors trained in 2001 registered sites through 2002 (Figure 6).

IOWATER Level 2 Workshops also debuted in 2001 (Figure 7). Four Level-Two Basic Training workshops trained 117 volunteer monitors for bacteria and chloride testing, 77 monitors at four Benthic Macroinvertebrate Indexing Modules got up close and personal with stream critters, 54 monitors attended the three Soils Modules, and the four Standing Waters Modules had 103 monitors in attendance.

Fourteen Level 1 workshops in 2002 resulted in 354 trained volunteers. Of those trained in 2002, 18% (64) registered sites and 69% (44) submitted data for their site (Figure 8).

In regards to IOWATER Level 2 Workshops in 2002, four Basic Training Workshops were attended by 43 volunteers, four Benthic Macroinvertebrate Indexing Modules trained 42 monitors, three Soils Modules had 16 participants, 35 volunteers attended three Standing Waters Modules, 32 monitors registered for the three Water Ecology Modules, and three Secondary Educators' Modules had 25 volunteers in attendance (Figure 9).

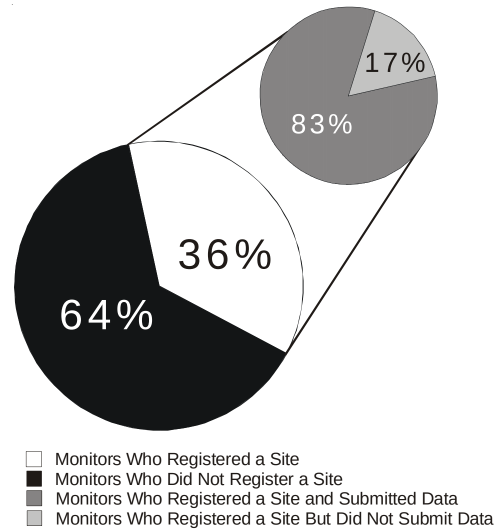


Figure 5. *Site registration and data entry participation from monitors in 2000.*

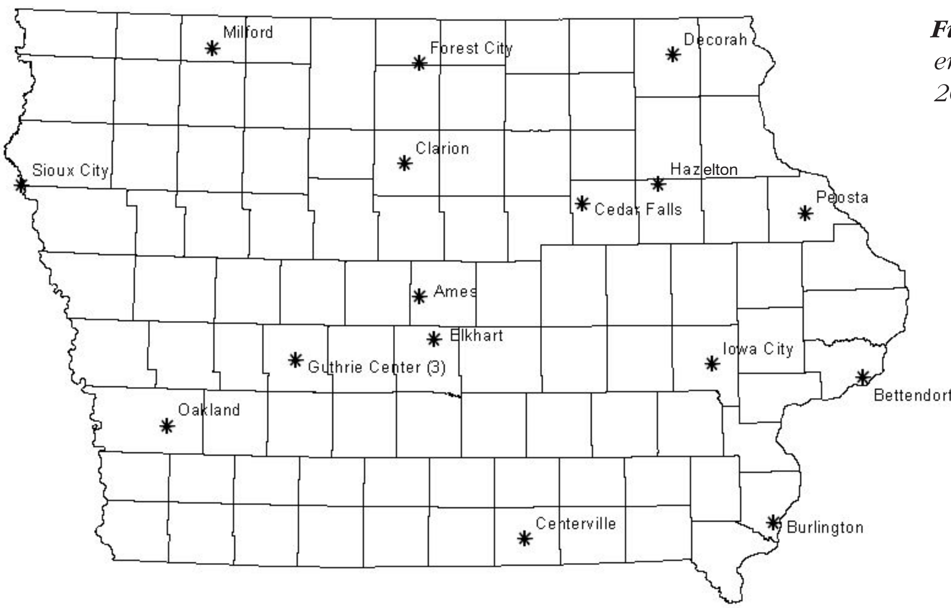


Figure 4. *IOWATER Level 1 workshop locations in 2000.*

Figure 10 shows the number of people, by year, who attended IOWATER Level 1 workshops, registered sites, and submitted datasets to the online database. Analysis of the data suggests that those trained in 2000 have been the most active participants, registering nearly 59% of all registered sites and submitting 73% of the data (Figures 11 and 12). Many of the volunteers trained in 2000 have become leaders in the IOWATER program by developing and supporting monitoring groups, locally facilitating workshops and encouraging others to become involved, and coordinating and conducting activities throughout their watersheds.

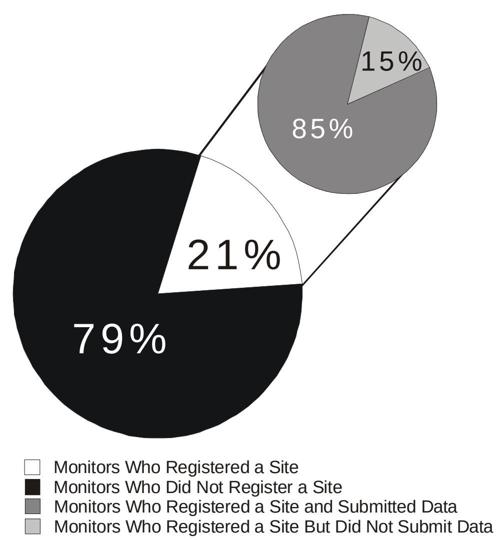


Figure 6. *Site registration and data entry participation from monitors in 2001.*

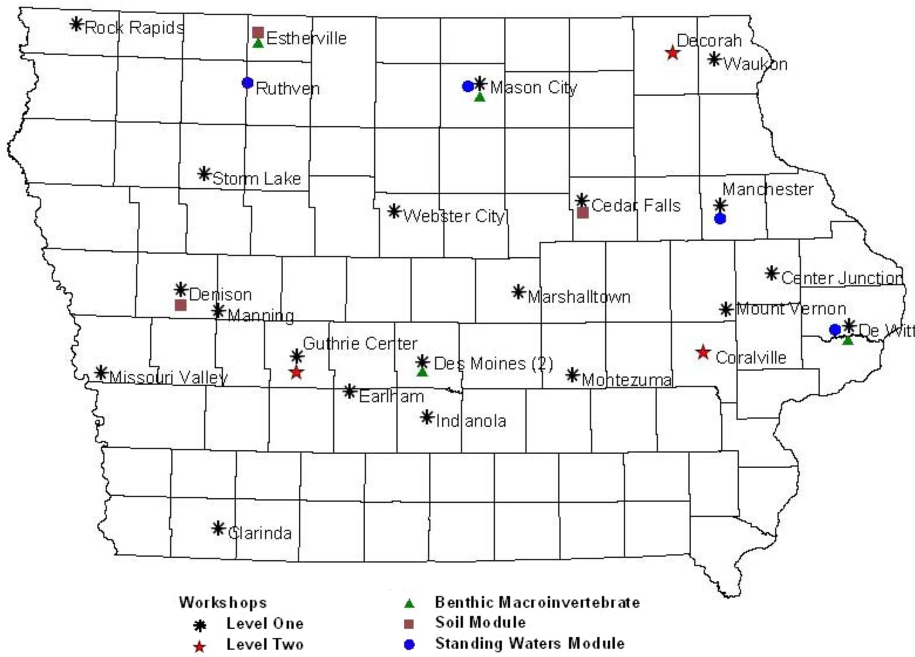


Figure 7. *IOWATER workshop locations for 2001.*

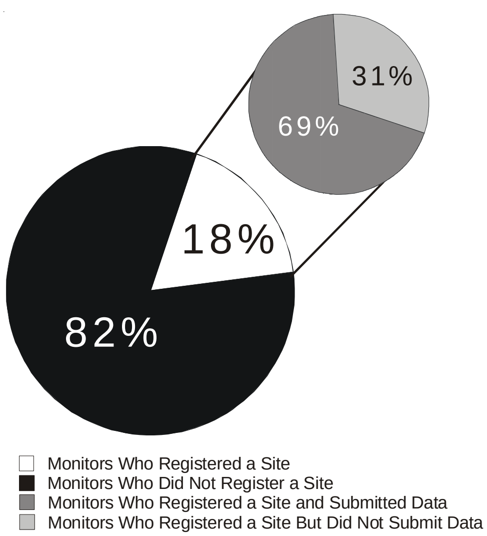


Figure 8. *Site registration and data entry participation from monitors in 2002.*

Generally, in order to assess a water body, a minimum of monthly samples is recommended. Basically, the more routinely a site is monitored, the more usable the data are for interpretation or regulatory purposes. Figure 13 shows the number of data sets submitted per site.

IOWATER and Iowa's Water Monitoring Program

The IOWATER program is aptly housed within the Water Monitoring Program of the Iowa Department of Natural Resources (DNR; Figure 14). This proves to be a nice fit considering the Water Monitoring Program coordinates and conducts much of Iowa's professional water monitoring efforts. There are certainly advantages to this relationship.

Similar Missions – Although IOWATER's mission is much less technical and more focused on awareness and education than the Water Monitoring Program mission, both programs share the goal of monitoring water quality and gathering data that can be used to maintain and improve the quality of Iowa's water, as well as establishing and maintaining accessible databases that can aid in the use of the data. Furthermore, having the Water Monitoring Program as a partner helps to build program credibility by linking the professional scientific community with volunteer citizen scientists.

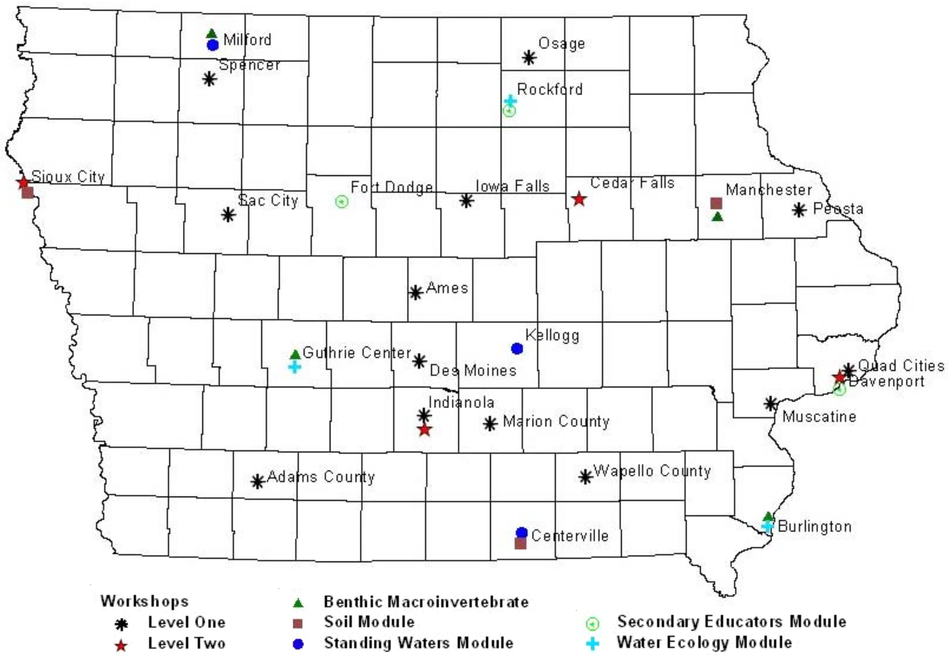


Figure 9. *IOWATER workshop locations for 2002.*

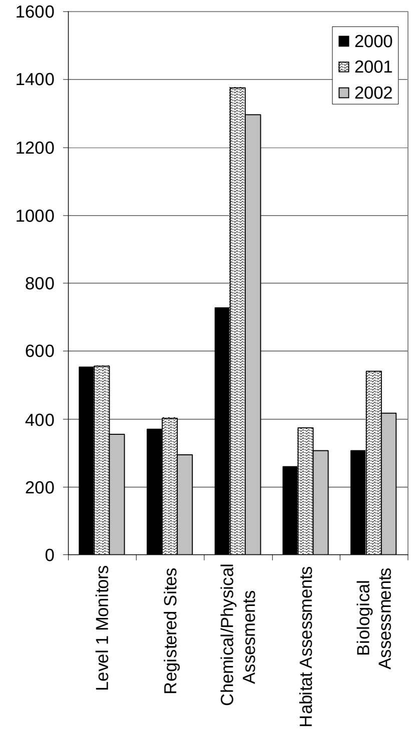


Figure 10. *Number of trained Level 1 monitors, registered sites and data submissions.*

Program Funding – Iowa's Water Monitoring Program receives its state funding from infrastructure funds. For fiscal year (FY) 2002, $2.5 million was appropriated to the Water Monitoring Program. Originally, IOWATER was funded through the United States Environmental Protection Agency (USEPA) Project 319 grants, Sportfish Restoration Funds, and Resource Enhancement and Protection (REAP) grants, but now the program's budget consists solely of ten percent of the annual infrastructure funds the Water Monitoring Program receives.

Credible Data Law

The use of water quality data can basically be broken down into either regulatory or non-regulatory uses. Data used in the non-regulatory arena may be used for such things as local decision making issues, trend identification, or early warning sign indicators of a pollution problem. Clean Water Act (CWA) applications, such as determination of whether or not water bodies meet their designated uses, are examples of regulatory uses of water quality data [303(d) list, Total Maximum Daily Load (TMDL)]. Historically, only data gathered by the state, or by agencies contracted by the state, were considered credible and usable for regulatory purposes. Iowa's credible data law, however, made it possible for volunteers to contribute credible water quality data for regulatory uses, an opportunity not previously available.

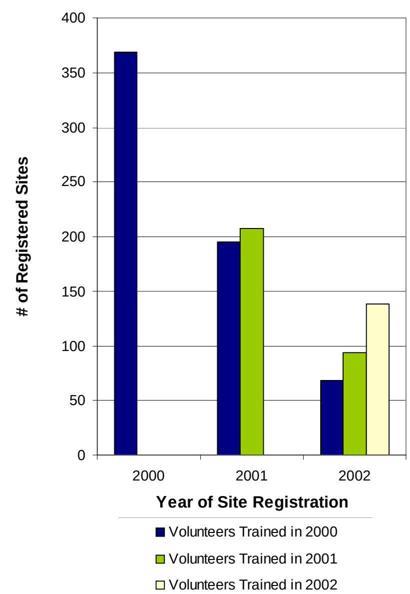


Figure 11. *Number of sites registered by volunteers trained in 2000, 2001 and 2002.*

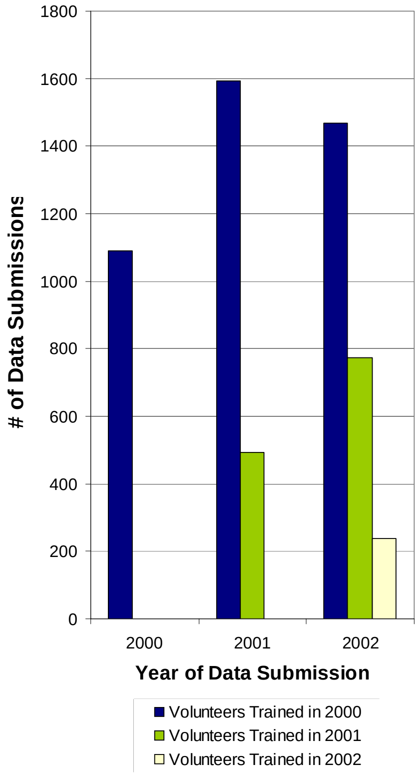


Figure 12. *Number of datasets submitted by volunteers trained in 2000, 2001 and 2002.*

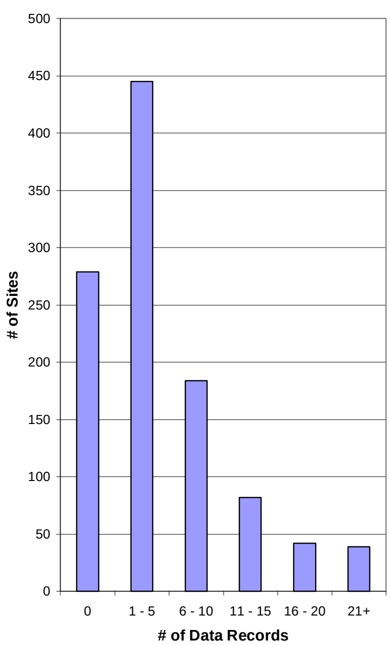


Figure 13. *Number of data records (chem/phys, biological, or habitat) per site 2000-2002.*

In 2000, Iowa citizens concerned about water quality urged the Iowa General Assembly to pass legislation that instituted a credible data law that recognized the existence of qualified volunteers and established a clear definition for the term "credible data." In order to understand Iowa's credible data legislation, definitions of key terminology must be understood. According to Iowa Code 2001: Section 455B.171, "*credible data* means scientifically valid chemical, physical, or biological monitoring data collected under a scientifically accepted sampling and analysis plan, including quality control and quality assurance procedures." In regards to IOWATER, this means that data obtained using IOWATER methods can be considered credible and therefore be used for regulatory purposes within the state of Iowa. Data provided by just any IOWATER volunteer, however, may not necessarily be considered credible. Only data provided by the DNR, a professional designee of the department, or a ***qualified*** volunteer are deemed credible. Therefore, the distinction between "regular" volunteers and "qualified" volunteers is of particular importance.

According to the DNR, "*Qualified volunteer* means a group of people acting on their own behalf, and not for a government agency or under contract with the department, to produce water quality monitoring data in accordance with a department-approved volunteer monitoring plan." Basically, this definition includes IOWATER volunteers and their data, but in order for the data to be considered credible and the volunteer to be considered qualified, a Quality Assurance Project Plan (QAPP) must first be approved by the DNR. Upon completion of an IOWATER workshop, volunteers are not considered to be qualified. They are, however, considered to be trained volunteers because IOWATER workshops provide the training and experience that ensures quality assurance and quality control for the data being collected. In order for them to become qualified volunteers, they must submit a QAPP to the IOWATER program. This plan basically requires answers to the who, what, when, where, and why questions – Who is doing the monitoring? When is the monitoring conducted? Where is (are) the monitoring location(s)? What is the intent of the monitoring effort? Once completed, the person(s) listed in the QAPP earns the respect and honor that accompanies the coveted title of "qualified volunteer" and their data is deemed "credible." With this ground-breaking legislation, the power to make a difference in Iowa's water quality rests both in the hands of our volunteers and in the DNR.

How can the IOWATER data that are collected, whether qualified or not, be used? Read on.

IOWATER DATA

IOWATER Data and the Meaning of Life

Many of us have taken time out of our hectic schedules to routinely monitor our IOWATER sites. When asked the question, “Why do we monitor?” we all have our own reasons. Some of us monitor to satisfy our curiosity, others want to find out what’s in the water that our children play in, and others want to help the state of Iowa better understand our water resources. There are absolutely no wrong answers to this important question, and for all reasons we’d like to say a heartfelt, “Thank you!” and “Keep up the good work!” IOWATER is a program for all of us and we are encouraged to shape the program to suit our needs – whatever those needs may be.

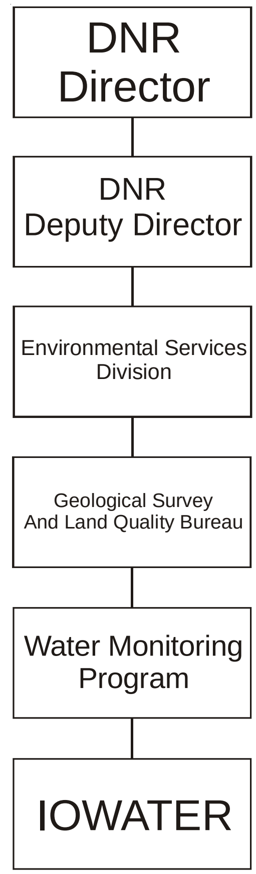


Figure 14. *IOWATER’s organizational structure.*

For volunteers who want the State to use their data, there has been some confusion about how the state may or may not use volunteer data. This confusion has led some people to make the incorrect assumption that the State does not use or value this data. Let’s “clear the water,” and discuss how the State of Iowa uses information collected by volunteers.

Uses of water-quality data are best understood if we break them down into regulatory and non-regulatory uses. Data collected for regulatory purposes are used to support legal action and have a much higher “burden of proof.” In the state of Iowa, regulatory data may be collected to determine if someone is exceeding their wastewater discharge permit, dumping chemicals illegally, or violating other water-related laws. By comparison, non-regulatory data may be collected for research purposes or to understand and track the status and trends of Iowa’s water quality. Because these purposes do not have legal ramifications, the requirements of the data may be much less stringent.

What does all of this have to do with volunteers?

The primary way that volunteer data could be used for regulatory purposes within DNR is through the development of the 305b Report and the 303d List. Section 305b of the Federal Clean Water Act (CWA) requires that states assess their waters every two years and to report the status of their waters in a report commonly referred to as the “305b Report.” Waters that do not meet their “beneficial uses” are then listed according the requirements of the Clean Water Act Section 303d. Beneficial uses are made up of “general uses” and “designated uses” and refer to the intent of the Clean Water Act to maintain the integrity of our nation’s waters. The different categories of designated uses are Class A (Primary Contact or Swimmable), Class B (Aquatic Life or Fishable), and Class C (Drinkable). Waters that have designated uses are protected to a higher degree than general use waters, which are prohibited from excessive pollution or gross negligence. Table 2 at the end of this section shows the water quality standards for various designated uses.

Because data used to assemble the 303d list have regulatory implications (including more stringent wastewater permits, changes in farming practices, and potential lawsuits), the DNR has developed guidelines or recommended methods of monitoring. These guidelines state that **a minimum of monthly sampling** (except when the water is frozen) is necessary to accurately assess whether or not a water body is impaired. The data used to make the assessment should also be collected over a designated two-year period. For the most recent assessment, this two-year period ran from Oct 1, 1999 through September 30, 2001.

In order make sure that data collected by volunteers were strong enough for the DNR's *regulatory* functions, the Iowa Legislature passed the Credible Data Law in 2000. This law sets the standard for volunteer data to be used in DNR's regulatory programs and basically requires Quality Assurance Project Plans in order for data to be considered credible. Quality Assurance Project Plans (QAPPs) document the methods used to collect samples, the personnel who collected the sample and their level of training, and the methods used to analyze the samples. The standard applied to the volunteer data is the same standard that professional data is held to for use in regulatory programs.

While the Section 305b Report is mandated by the Clean Water Act, in many ways its function is non-regulatory. Its purpose is to describe the status of the State's water quality and the extent to which state waters meet the goals of the CWA. Iowa's credible data law does not require that volunteer data be covered by a QAPP in order to be included in the 305b Report (although it is certainly desirable). As with the 303d List, it is suggested that volunteer data be collected on a monthly basis during the two-year reporting period so as to provide an accurate assessment.

Was volunteer data used in the current 305b Report and 303d List?

The short answer is yes and no. Most IOWATER volunteers did not become trained until well into the current reporting cycle and we did not provide guidelines to you on the desired monitoring frequency. Therefore, it was difficult to do a full assessment on volunteer data. Additionally, the rule requiring a QAPP for 303d listing was only just finalized in August of 2002. However, the State has been looking at the volunteer data. Where the data was incomplete or inconclusive in order to make an accurate assessment, the site has been placed on a list for further investigation. As with any new program, we have learned valuable lessons in how to fit within an existing framework and will be better able to contribute to the next reporting cycle.

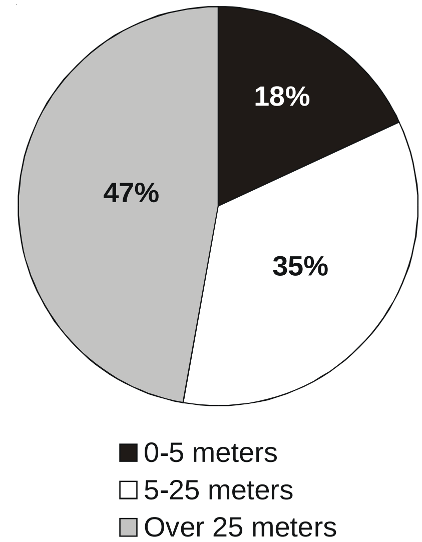


Figure 15. *Riparian zone widths along IOWATER monitoring sites.*

Is there life beyond 305b and 303d?

Not surprisingly, the regulatory world has many hoops and hurdles. If you are feeling discouraged, read on! In many ways, the non-regulatory uses of water quality data are just as important and pertinent to improving our water quality. Much of the data collected by scientists never sees a courtroom or a regulator's desk, but is used to guide and shape our understanding of water quality in such a way to make positive changes. For example, much of the water quality data collected historically has been on larger rivers and streams. The information you collect on small streams helps to fill a large gap in our understanding of the role of headwater streams on the ecology, nutrient cycling, and overall health of our aquatic environments, even if it never sees the pages of a 303d List. Volunteer data is being used to identify areas in need of more in-depth professional monitoring, direct land-use activities, and to determine where effective implementation of best management practices could improve water quality.

So how is volunteer data being used in non-regulatory ways?

Several examples are provided here to help you understand how the state uses the data today and what future uses may arise.

One of the key questions about our streams today is related to the condition of stream banks and the amount of riparian vegetation in the stream corridors. Efforts to stabilize stream banks and plant buffer strips to filter nutrients will only have limited success if the small, headwater streams do not have adequate riparian corridors. By looking at the percentage of IOWATER sites with riparian corridors less than five meters (Figure 15), we can see that there is still an enormous potential for continued erosion of stream banks and movement of nutrients into the stream. This potential may vastly overwhelm the efforts we have made on larger streams. Furthermore, much of the ecological "energy" is produced in the small headwater tributaries. Leaf litter, macroinvertebrates, and rooted vegetation are the base of the complex food web that supports the larger streams. Your observations on the presence of these energy sources or lack thereof, help scientists understand the downstream condition of Iowa's larger streams. For example, the graph showing the percentage of canopy cover suggests that there isn't much vegetation shading our headwater streams (Figure 16). This indicates that ecological "energy" production from the riparian corridors could be increased if canopy cover increases.

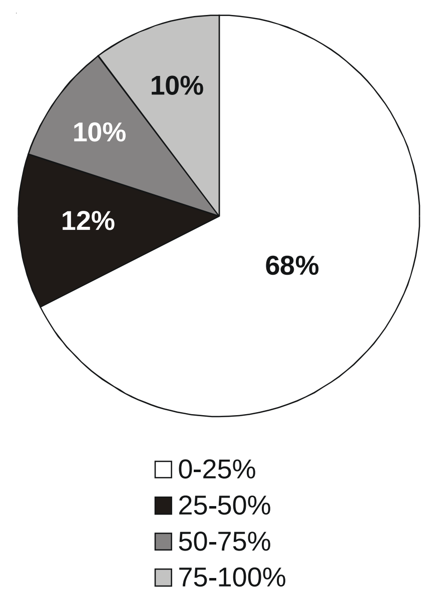


Figure 16. *Canopy cover over IOWATER monitoring sites.*

Volunteer data has also been used to document instances of excessive pollution in general use streams. These volunteers have worked with local, county, and state officials to identify the sources of pollution and to begin the process of addressing these sources through a variety of state and federal programs. Because this type of gross pollution is more likely to be found in small streams where volunteers focus their monitoring (larger streams are more able to dilute and process the pollution), the role of volunteers in identifying this type of pollution and informing state officials is very important.

One of the most expensive and difficult parts of assessing a watershed is the labor involved with collecting data at many different sites. In some cases, it is necessary to collect lots of data during a very short time period in order to see the variation in chemical or physical tests throughout the watershed. This is where monitoring partnerships between volunteers and state and local officials have been extremely helpful. So far, "snapshot" sampling events around the state have helped to isolate "hot spots" or areas where more focused monitoring is needed. For example, IOWATER-trained volunteers participated in a snapshot sampling of the Cedar River during the summer of 2000 and again in the spring of 2001. More than 60 sites covering the area from the headwaters in Minnesota to the mouth at Conesville, Iowa were sampled within a four-hour period. This sampling event highlighted areas of higher than average bacteria counts within the urban area of Cedar Rapids and resulted in the Linn County Health Department developing a focused project to examine the causes and possible solutions to the bacteria levels.

A snapshot sampling in Scott County looked at the differences in water quality between the rural and urban areas and shows the impact of land-use changes along the urban fringe. A professional/volunteer partnership sampling on Whitebreast Creek in southern Iowa is being used to identify areas where best management practices could be implemented to improve the overall water quality. Without the participation of volunteers, snapshot sampling can become prohibitively expensive and therefore would limit our ability to collect this type of data. Because *trained* volunteers are participating in these efforts, the credibility and quality of the data collected is enhanced, while ensuring a quantity of data that assists the State in protecting our water resources.

How can we continue to expand the usefulness of volunteer data?

The IOWATER team is working to develop tools to better interpret the data in the future. One of the challenges for data collected by both professionals and volunteers is determining how habitat and biological data reflect water quality. In some cases the answer is obvious (when all you find are bloodworms). But when the impacts are more subtle, it takes more sophisticated tools to understand the changing water quality. In particular, the IOWATER staff will be working with volunteer coordinators in other states to explore ways of summarizing the benthic data to provide more information than just presence/absence.

We are also looking at new test methods to better match the data needed by the staff writing the 305b Report and 303d List. We have been field testing a new ammonia test for the past several months and hope to be able to provide volunteers with this new test in the coming months. Keep in mind that the IOWATER program was just beginning to get its feet wet during the current 305b reporting period. As volunteers continue to collect data in the future, the data will more completely cover the reporting period and will become increasingly valuable to the State as longevity is the single most powerful element to a dataset.

Beneficial Uses of Iowa's Waters

Beneficial Uses can be found in Chapter 61 of Iowa's Water Quality Standards http://www.epa.gov/waterscience/standards/wqslibrary/ia/ia.html

Beneficial Uses are also available on the IOWATER interactive map at www.iowater.net

305b Report Guidelines

Monthly sampling frequency is suggested for chemical tests (when open water is present, do not walk on thin ice or sample when water is too high to be safe).

303d List Guidelines

State approved Quality Assurance Project Plan is required (see IOWATER staff for help writing QAPP and receiving approval). Monthly sampling frequency is suggested for chemical tests (when open water is present, do not walk on thin ice or sample when water is too high to be safe).

IOWATER Parameters

Volunteers who attend IOWATER Level 1 workshops are trained on 27 different parameters that are part of four different assessments – biological, chemical, habitat, and physical assessments. All of the parameters have been designed to be completed in the field and all of

Table 2. *Beneficial uses and the parameters and impairment limits that affect them.*

Beneficial Uses	Parameters Used to Determine Impairment	Impairment Limits
Designated Beneficial Uses		
Class A – Primary Body Contact (Swimmable)	pH Fecal Coliform Bacteria	• pH less than 6.5 and greater than 9.0 may constitute impairment • Fecal coliform populations of 200 organisms/100 ml or higher may constitute impairment unless waters are "materially affected by surface runoff."
Class B – Aquatic Life (Fishable)	Dissolved Oxygen pH Temperature	• Dissolved oxygen levels can be variable. Generally, DO levels less than 5.0 mg/L may constitute impairment. For coldwater streams levels less than 7.0 mg/L may constitute impairment. • pH less than 6.5 and greater than 9.0 may constitute impairment • Temperature ranges are variable. Generally, increases in temperature cannot occur at a rate faster than 1°C/hour and not exceed a specified temperature or number of degrees; in no case should added heat raise water temperatures above 32°C.
Class C- Drinking Water (Drinkable)	Nitrate Nitrite pH	• Nitrate levels greater than 10 mg/L may constitute impairment. • Nitrite levels greater than 1 mg/L may constitute impairment. • pH less than 6.5 or greater than 9.0 may constitute impairment.
General Beneficial Uses		
General Use	Various	• Gross negligence and extreme conditions caused by pollutants may constitute impairment.

Note: As of July 2003, the bacteria standard changed to an *E. coli* level of 126 CFU/100ml.

the monitoring equipment needed to conduct the monitoring for each parameter is issued to all IOWATER volunteers upon completion of a workshop. IOWATER Level 2 workshops train volunteers in two additional parameters – chloride and bacteria. Chloride monitoring is done with a field test kit, while bacteria monitoring may involve many days, as the bacteria must be incubated and cultured before it can be counted.

All of the equipment and associated costs needed to measure IOWATER Level 1 and Level 2 parameters are listed in Table 3. The equipment is issued to all volunteers who complete IOWATER workshops. The invaluable contributions of volunteers, which not only consist of data collection and entry, but also education, awareness, and advocacy, more than cover the program costs spent on each IOWATER monitor.

Table 3. *Equipment costs.*

IOWATER Equipment	Price per Item
Aquatic Dip Net	$21.45
Dissolved Oxygen Test Kit	$38.00
Phosphate Test Kit	$45.85
Thermometer	$5.95
Tape Measure	$29.75
pH Test Strips	$8.95
Nitrite/Nitrate Nitrogen Test Strips	$14.95
Transparency Tube	$25.00
Safety Glasses	$1.26
Plastic Tub	$0.77
Stakes	$1.00
Rope	$1.34
Clothespins	N.A.
Tennis Ball on 1-Meter String	$1.63
Clipboard	$1.20
3-Ring Binder	$1.99
Streamkeeper's Field Guide	$16.47
Canvas Bag	$4.29
Forceps	$0.06
Magnifying Cube	$0.89
Meter Stick	$0.90
Total for Level 1	**$221.70**
Chloride Titrators	$25.75
Bacteria Media (ten per person)	$7.50
Styrofoam Cooler	$3.80
Meat Thermometer	$17.92
Petri Dishes (ten per person)	$7.50
Permanent Marker	$0.45
Eyedropper	$0.10
Chloride Beaker	$0.20
Extension Chord	$0.97
Scotch Tape	$0.88
Night Light	$1.75
Bleach Bottle	$0.30
Total for Level 2	**$67.12**
Total for IOWATER Level 1 and 2	**$288.82**

Biological Assessment

Benthic Macroinvertebrates – One easy (and FUN) way to assess water quality in a stream is to look at the benthics that live in it. Some benthic macroinvertebrates require very specific habitat requirements. If these requirements are not met, they can no longer survive. The presence or absence of these organisms can provide a good assessment of stream quality. Benthic macroinvertebrates are assessed because they:

- Are stable in their range (they cannot travel very far)
- Are easy to collect and identify
- Have known tolerance levels to different pollutants

Benthic macroinvertebrates can be grouped into three different categories, depending on their tolerance levels.

- *Pollution Intolerant* (High Quality) – Unable to survive in the presence of pollution. Presence of these critters indicates a healthy stream.
- *Somewhat Pollution Tolerant* (Middle Quality) – Can survive in slightly polluted streams. Excessive pollution, however, can wipe them out.
- *Pollution Tolerant* (Low Quality) – Can survive essentially anywhere because pollution has little or no effect on them. (NOTE: Finding a species from the pollution tolerant group does not automatically indicate an unhealthy stream – they can live anywhere!)

Aquatic Plant Cover of Streambed – The plants that are growing within a stream can be a good indicator of productivity and nutrient availability. Generally, plant cover is a good thing, but an over-abundance of plant cover may indicate abnormally high nutrient levels and lead to other water quality problems.

Algae Cover of Stream or Streambed – Algae cover, like aquatic plant cover, can be a good indicator of productivity and nutrient availability. Algal growth that gives the water a green color may indicate the presence of excess nutrients.

Chemical Assessment

pH is a measure of how acidic or basic (alkaline) the water is. In Iowa, pH generally ranges from 8.1 – 8.5 because of our limestone-rich soils, which neutralize any acidic inputs (acid rain, point sources, etc.). Values above 9.0 (basic) may be caused by algal growth, while values below 6.5 (acidic) are generally caused by point sources of pollution.

Nitrite is a relatively unstable form of nitrogen that can be present along with nitrate, which is more stable. Nitrite itself cannot be used for growth by algae or plants, but it can convert to nitrate, a usable nutrient.

Nitrate is a stable form of nitrogen that is soluble in water and can be readily transported to streams by runoff during rain events. In humans, specifically in infants, nitrate can prevent the blood from picking up oxygen, resulting in what is known as "Blue Baby Syndrome." In water bodies, nitrate is taken up by aquatic plants and algae, so productivity increases. Excessive productivity leads to hypoxic, or low-oxygen, conditions as the plants and algae die, decompose, and deplete oxygen levels in the water.

Orthophosphate, like nitrate, is also a nutrient that increases plant and algae productivity, which may lead to hypoxic conditions if excess amounts are introduced to a water body. Phosphate is taken up by plants and algae much more readily than nitrate. Therefore, plant growth in surface waters is generally limited by the amount of phosphate present. IOWATER measures the concentration of orthophosphate, which is also known as "free" phosphate. It is the simplest form of phosphate and is readily taken up by plants when it is available. Organic phosphate, which is phosphate that is part of living organisms' cells, is not measured using this method. Consistent, elevated concentrations of orthophosphate may indicate a constant, unnatural source.

Dissolved Oxygen – All living things, aside from anaerobic bacteria, need oxygen to survive. Plant cells consume oxygen as they undergo respiration, and give off oxygen as they process sunlight and carbon dioxide into glucose (food). As plants, algae, and animals die and decompose, bacteria involved in decomposition use up oxygen dissolved in the water. When a large number of organisms die, large amounts of oxygen are used up and hypoxic, or low-oxygen, conditions result, stressing the organisms that remain.

Habitat Assessment

Stream Habitat Type – Stream habitats can be divided into three main types: runs, riffles, and pools. Generally, a healthy, meandering stream will consist of a series of moderately flowing runs, followed by deep, slow-moving pools, which transform into shallow, swiftly moving riffles. Because of the shallow water level and the swift current of riffles, dissolved oxygen levels are higher and benthic macroinvertebrates are more abundant than in pools or runs.

Streambed Substrate – The characteristics of the stream bottom are very important to habitat quality and the type of aquatic life you may find there. The proportions of silt, sand, gravel, cobbles, boulders, and bedrock present in the stream bottom directly affect what can live there. For example, streams with very silty bottoms would fill in any open spaces between rocks, roots, or vegetation, thereby eliminating habitats necessary to support some benthic macroinvertebrate populations.

Microhabitats – Microhabitats are places where aquatic organisms actually live. Within each run, riffle, and pool, many different microhabitats exist. Algae mats, leaf packs, logjams, rock piles, root wads, undercut banks, and weed beds are examples of some common microhabitats. When sampling for benthic macroinvertebrates, it is very important to sample and record every available microhabitat within the stream reach that encompasses the sampling site. Different microhabitats may be home to different species of benthic macroinvertebrates.

Stream Banks – The condition of the stream banks can be a good indicator of stream quality. A stable stream bank is a sign of a stable stream. Basically, if stream banks do not migrate readily (they are not easily eroded) and support a lot of vegetation, they are considered to be stable. Unstable stream banks contribute sediment to a stream, which can alter aquatic populations and the shape of the stream itself.

Canopy Cover – Canopy cover is everything above the stream that can block sunlight and provide the stream with shade. The absence of canopy cover means more sunlight reaches the stream, leading to higher stream temperatures and decreased ability to hold oxygen. If the canopy of a stream is reduced or eliminated, the health of the stream suffers.

Riparian Zone Width – The natural plant community adjacent to streams is referred to as the riparian zone. Vegetation in riparian zones helps to stabilize stream banks and provide canopy cover and wildlife habitat. An important function of riparian corridors, in terms of pollution control, is their filtering capability. The wider the riparian zone, the greater ability it has to filter out pollutants (sediments, nutrients, etc.) that may be traveling with rainwater runoff.

Riparian Zone Plant Cover – A healthy riparian zone consists of trees, shrubs, and grasses. Generally, the more diverse the plant communities are in riparian areas, the more diverse the wildlife is, as well. Differences in plant cover affect the filtering capabilities of the riparian zone.

Adjacent Land Use – The activities that take place in the watershed have direct impacts on water quality. In other words, water quality is a direct reflection of land-use practices. Therefore, land uses that contribute pollutants to the surrounding landscape pose a risk for the waters adjacent to them. Healthy, wide riparian zones help minimize impacts of land uses adjacent to streams.

Physical Assessment

Weather plays an important role in the chemical and physical conditions of a water body and it influences water quality in many different ways. Sunny weather, for example, can increase photosynthesis in plants and algae, resulting in higher dissolved oxygen concentrations. Windy weather can cause wave action to stir up sediments and increase turbidity, thereby decreasing light penetration.

Air Temperature affects the water temperature, which in turn affects other parameters. For example, higher air temperatures lead to higher water temperatures, which lead to lower dissolved oxygen concentrations.

Precipitation – Generally, pollutants travel to streams with rainwater runoff. Therefore, unusually high concentrations of bacteria and nutrients after rainstorms are quite common. When interpreting data, it is important to consider the effects of precipitation.

Water Color can provide immediate clues to stream conditions. For example, brown water can indicate high sediment levels, and green water may be caused by algae growth.

Water Odor, like the water's color, can provide immediate clues about potential problems in a stream. For example, if water smells like manure, it probably contains some.

Stream Width – If the width of a stream changes dramatically over time, there's a possibility the banks are unstable and the water quality of the stream is being degraded.

Stream Depth is important for many aquatic organisms. As with stream width, dramatic changes in stream depth may be the result of unstable stream banks and degraded water quality.

Stream Velocity is a measure of how fast the water is flowing. Healthy streams have meanders, logjams, and other obstructions that cause variations in water velocity, thereby creating diverse habitats.

Stream Flow (Discharge) is a measure of how much water passes a given point in a given time. It is important to understand how stream flow influences water quality. Low flows occur during dry conditions. During these times, point source pollution can have major effects because they have no chance of being diluted. Non-point source pollutants, however, are not transported to streams due to the lack of precipitation and runoff. In wet years, high flows may dilute point sources of pollution. Non-point sources, on the other hand may be continually washed into streams and degrade water quality. When interpreting data, it is important to account for the effects of flow on other water quality parameters.

Water Temperature is directly affected by air temperature and the temperature of the ground. It has a direct effect on dissolved oxygen levels; colder water can hold more dissolved oxygen than warmer water. Water temperature is very important to northeast Iowa streams where trout populations require cold water throughout the year.

Transparency is a measure of water clarity and is affected by the amount of material suspended in water. Low transparency (unclear water) limits sunlight penetration, and as the suspended materials settle out, they fill in habitats, clog gills of benthic macroinvertebrates, and reduce food availability.

Level 2 Assessments

Chloride is a natural element found in salts. Sources of chloride may include human or animal wastes, fertilizer runoff, or "road salt" runoff in the winter and spring. Chloride can be used as a "conservative" measure of water contamination because natural processes, such as breakdown by bacteria, do not affect its concentrations. In other words, fecal inputs to water bodies would include inputs of both indicator bacteria and chloride. While indicator bacteria may be killed by sunlight or broken down by other bacteria in the stream, high concentrations of chloride could still indicate the presence of fecal contamination.

Bacteria – Certain bacteria, known as "indicator" bacteria, can indicate water contamination by fecal matter (Figure 17). While these

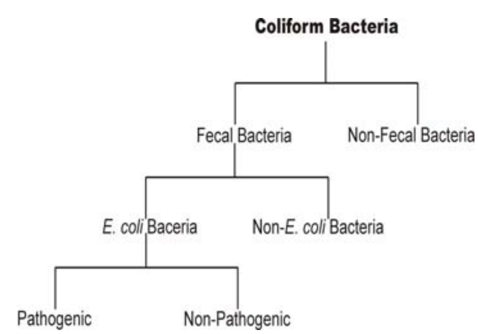


Figure 17. *Bacterial relationships.*

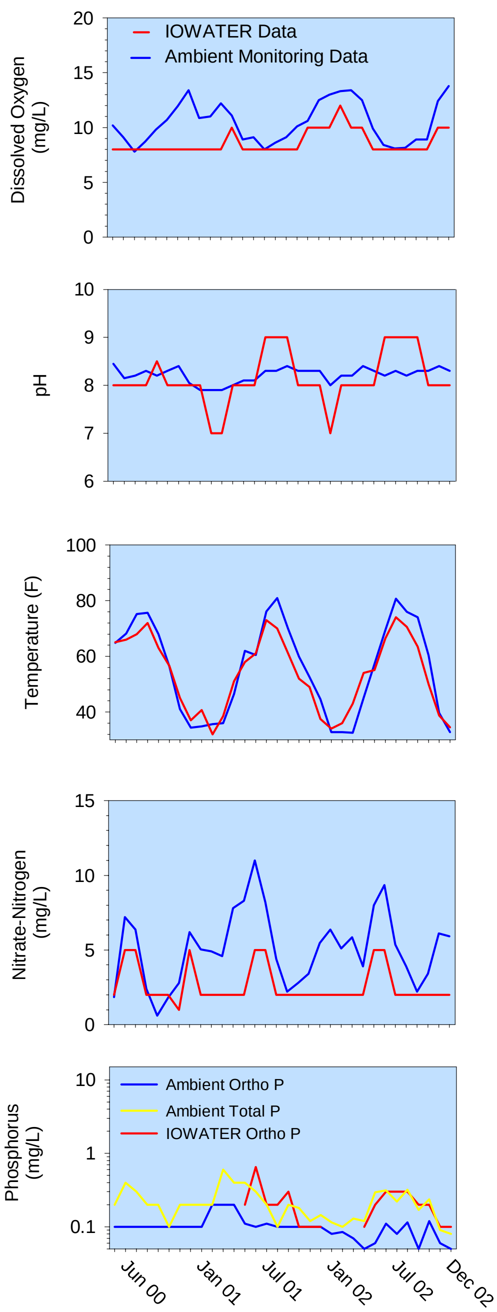


Figure 18. *Statewide comparison between IOWATER and professional ambient water monitoring data from May 2000 to December 2002. Note: IOWATER sites are not the same as the professional sites.*

bacteria themselves are not harmful to humans, they may have pathogens associated with them that can cause disease. High indicator bacteria concentrations increase the chance that disease-causing pathogens are present. IOWATER Level 2 bacteria methods measure *E. coli* and general coliform bacteria concentrations.

IOWATER Data vs. Professional Data

One of the major questions that has surrounded the IOWATER program from the beginning is, "How does IOWATER monitoring measure up to professional monitoring?" In other words, are the data obtained through IOWATER credible?

The five graphs in Figure 18 were compiled by averaging the monthly results from each program (IOWATER and Iowa's Water – Iowa's Ambient Monitoring Program) and plotting them together. Although it may be a gross comparison, IOWATER data does appear to reflect statewide water quality trends. Data collected by IOWATER methods are also accompanied by limitations. IOWATER methods of bacteria sampling can be used to determine total coliform bacteria. Formerly, state standards for Class A waters required fecal coliform bacteria counts, which could not be obtained using these methods. However, new water quality standards for 2003 focus on *E. coli* bacteria, a parameter that can be monitored using IOWATER methods. In order for data to be used for regulatory purposes, bacteria sampling must be done at least monthly, since it is the geometric mean (the fifth root of five monthly samples multiplied together) that determines impairment.

Limitations for dissolved oxygen (DO) methods exist because DO values are rounded to the nearest whole number. Furthermore, in the upper range of the DO color comparator, between 6 and 12 mg/L, only even numbered concentrations are available. These large gaps in DO concentrations make it difficult to accurately assess water bodies.

The same scenario is seen with the nitrate/nitrite test strips; exact concentrations cannot be obtained. For example, a water body with an actual nitrate concentration of 8.0 mg/L may register a concentration of 10 mg/L when assessed using IOWATER methods. Class C waters that have nitrate concentrations greater than 10 mg/L are not in compliance with state standards. Therefore, Class C waters in this scenario would be in compliance with state standards, but data from IOWATER methods would suggest that they should be considered impaired.

For pH, only whole numbers are listed, and the pH values only range from 4 – 9. Values above 9 can be cause for impairment, but these values cannot be obtained using IOWATER methods. Likewise, water bodies having an actual pH of 6.5 may be recorded as 6. For Class A, B, and C waters, pH values of 6.0 are considered below the acceptable range, while pH values of 6.5 are in compliance with water quality standards.

Limitations of temperature data exist not because the actual temperature readings vary, but because impairments due to temperature require nearly constant temperature monitoring data in order to determine whether or not there is a problem. For temperature impairments, rates of temperature change must be recorded, as well as the actual change in temperature.

Figure 19. *Dissolved oxygen color comparator scale.*

Even though limitations to IOWATER data exist, it is still valuable and can be used to identify trends, "hot" spots, areas in need of further monitoring, and, if enough data is available, it can be used for watershed assessments. This is possible because IOWATER data are comparable to professional data. Although not exact, the data do provide a "ball park" figure, and in many cases actual concentrations are underestimated.

Data from Iowa's professional water monitoring program are both accurate and precise. It is accurate because the methods measure exact concentrations, and it is precise because it can measure actual concentrations on a repeated basis. IOWATER methods, on the other hand, may be considered accurate, but not always precise (Figure 22). This is because although the sampling methods may not provide exact concentrations, repeated sampling results in similar data. The relative accuracy of IOWATER data is important because it allows for the identification of long-term trends in water quality. When making water quality assessments, it is very important that these trends are identified so accurate assessments can be made.

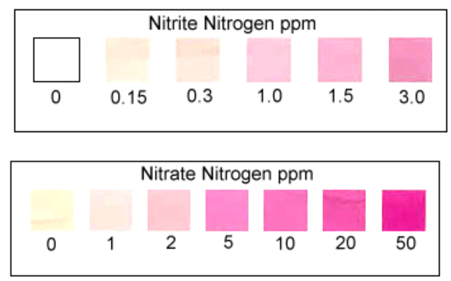


Figure 20. *Nitrite and Nitrate color comparator scales.*

IOWATER conducts side-by-side sampling in a continued effort to ensure quality and credibility of IOWATER data. Staff accompany professional monitors to the field, where data can be obtained from both IOWATER and professional methods at the same time and at the same place. When results from the professional monitoring are back from the lab, data gathered from the different techniques can be graphed against each other, and the question about accuracy and precision of IOWATER methods can be answered. Figures 23-28 show the results of IOWATER side-by-side sampling. Differences in the parameter scales are evident.

Because of expansive limestone bedrock that contributed to Iowa's limestone-rich soils, the pH of Iowa streams generally ranges from 8.1 to 8.5. Therefore, IOWATER pH test strips would indicate values of 8 or 9, depending on the observer's perception. Generally, data from

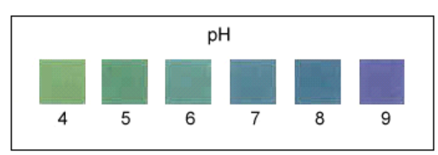


Figure 21. *pH color comparator scale.*

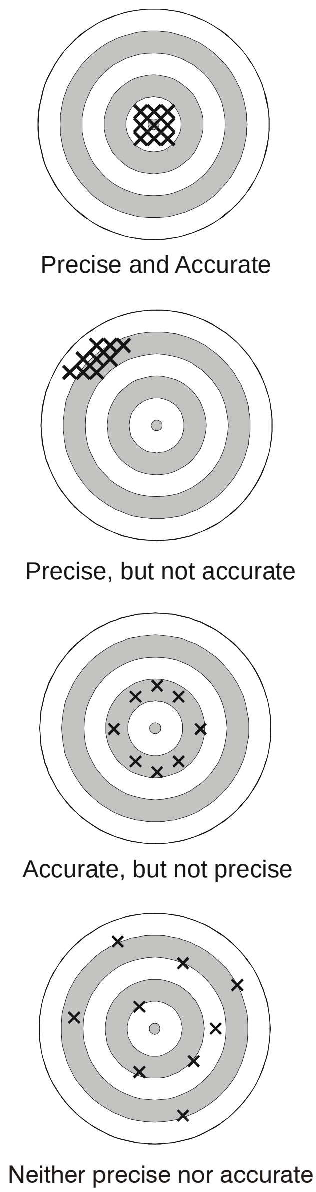


Figure 22. *Accuracy versus precision.*

IOWATER pH methods reflect those of professional collection methods, but the limitations previously discussed apply.

IOWATER dissolved oxygen data, although not as precise as professional data, appear to reflect actual dissolved oxygen concentrations.

Nitrate concentrations using IOWATER methods appear to underestimate actual concentrations determined using professional techniques.

Chloride values appear to match up closely with professionally obtained chloride concentrations.

Since soil from the suspended load can make readings using the orthophosphorus color comparator difficult, side-by-side sampling is conducted using both unfiltered and filtered water samples. There seems to be less variability among filtered samples.

It is unknown why this relationship exists, but IOWATER methods for measuring orthophosphorus concentrations appear to be more closely tied with professional total phosphorus concentrations. Limitations to IOWATER methods, namely color comparator scales, may provide clues to this phenomenon.

IOWATER Data – The Big Picture

Data From Chemical Assessments

Figures 29-46 show both the locations of IOWATER monitoring sites and the median values for each parameter. In a set of data, ranked in ascending order, the median is the value that falls in the middle – 50% of the values are lower and 50% are higher.

Median pH values for 2000 are consistent and there seems to be a good distribution of values ranging from 6 to 9. One area may be worth more scrutiny. The median value for many of the sites in Story County is nine. Is this an area that is experiencing consistently high pH, or are these pH values actually below, but recorded as, nine? Perhaps a look at the data through time may help answer this question.

For 2001, median pH values appear be around the expected 8.1 – 8.5 range. Once again the monitoring sites in Story County indicate the possibility of high pH values in this area.

Median pH values for 2002 provide limited evidence that the pH of the South Skunk River and Squaw Creek in Story County may be elevated. Perhaps the use of a pH meter would provide a definitive answer to the high pH question. One median value of four was recorded for a site in Bremer County on the Wapsipinicon River. However, upon closer examination of the data one would find that this value is only from one sample; it is nearly impossible to make predictions about a water body from one sample taken at one point in time. If continued, long-term data reveal consistent pH readings of four, however, a watershed investigation may be in order.

Median dissolved oxygen (DO) concentrations from 2000-2002 varied across the state, but for the most part were greater than 5 mg/L. During this period, some sites dropped below 5 mg/L, the water quality standard for warm-water streams. Low levels do not appear to persist at these sites from year to year, however, these sites have limited data available. There is a need for continual, long-term monitoring at these potential "problem" areas in order to accurately draw conclusions.

Nitrite-nitrogen values for 2000-2002 appear to be fairly low. However, there are a few "red flag" areas that also coincide with elevated nitrate concentrations.

The 2000-2002 median nitrate concentrations indicate that levels were pretty good. The nitrate concentrations between 2.1 – 5 mg/L are typical of nitrate concentrations in streams statewide. As a whole, median nitrate values were lower in 2000 and 2002, relative to 2001. These differences may be a result of climatic conditions, as both 2000 and 2002 reported below normal rainfall, while higher nitrate concentrations in 2001 correlate with wetter conditions that year (Figures 53-55).

The phosphate kit that IOWATER now uses was not adopted until 2001. For the most part, concentrations appear to be relatively low throughout the state. However, the lowest detection level of 0.1 mg/L is already above the proposed U.S. Environmental Protection Agency (EPA) water quality standard for total phosphorus in Iowa streams.

It is not surprising to find lower transparency readings in southern and western Iowa – the soils are more easily eroded in these areas. Consistent low transparencies in other parts of the state may be cause for concern. In these areas, sediment may be contributed to streams by runoff from construction sites or agricultural fields, and erosion from unstable banks caused by land-use practices.

IOWATER's chloride database is relatively small, mainly because there are relatively few Level 2 monitors. There are four sites that may indicate a problem, but three are the result of one-time sampling. A monitoring site on Catfish Creek in Dubuque County, however, has had repeated high concentrations, and further investigation is underway.

Figure 23. *Comparison of IOWATER and professional pH data.*

Graph shows results from lab versus IOWATER methods from the same sites. The solid line shows the relationship between the two. r^2 represents the strength of the relationship on a scale from 0 to 1. An example of a perfect relationship is represented by the dashed line. Any departure from that line is not a perfect fit.

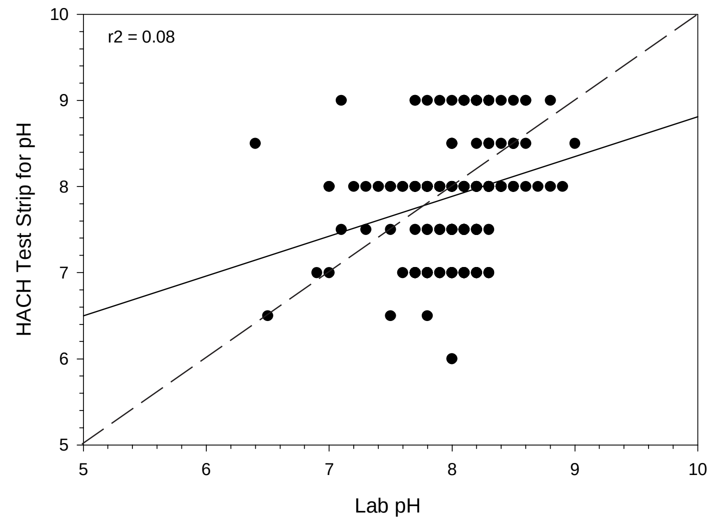


Figure 24. *Comparison of IOWATER and professional dissolved oxygen data.*

IOWATER dissolved oxygen data, although not as precise as professional data, appear to reflect actual dissolved oxygen concentrations.

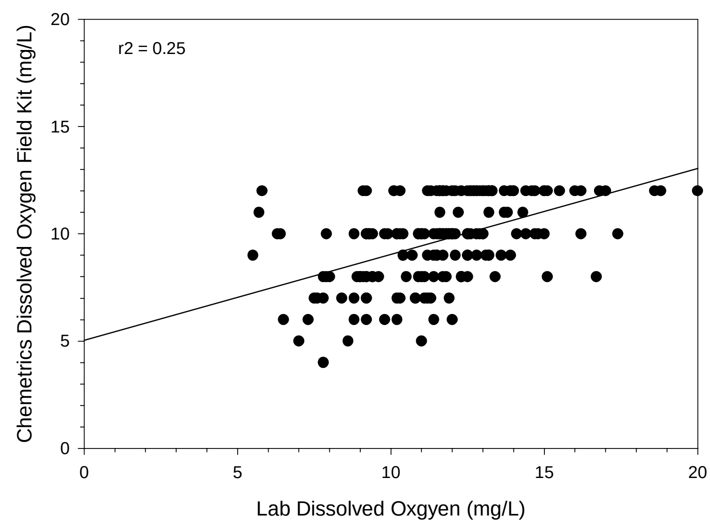
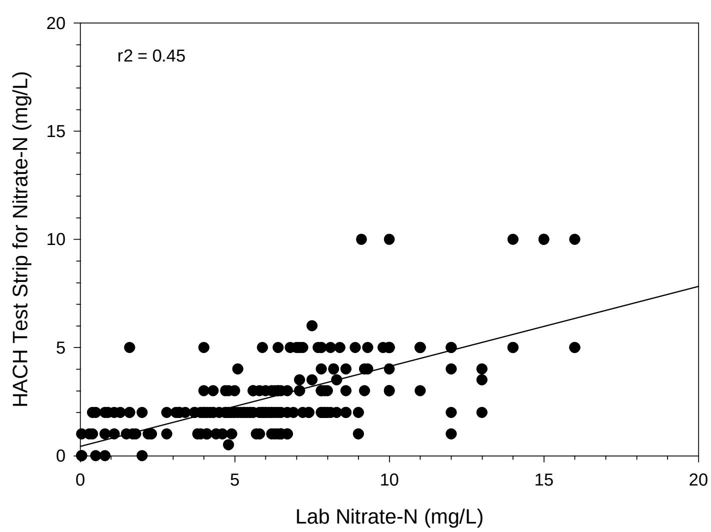


Figure 25. *Comparison of IOWATER and professional nitrate data.*

Nitrate concentrations using IOWATER methods appear to underestimate actual concentrations determined using professional techniques.



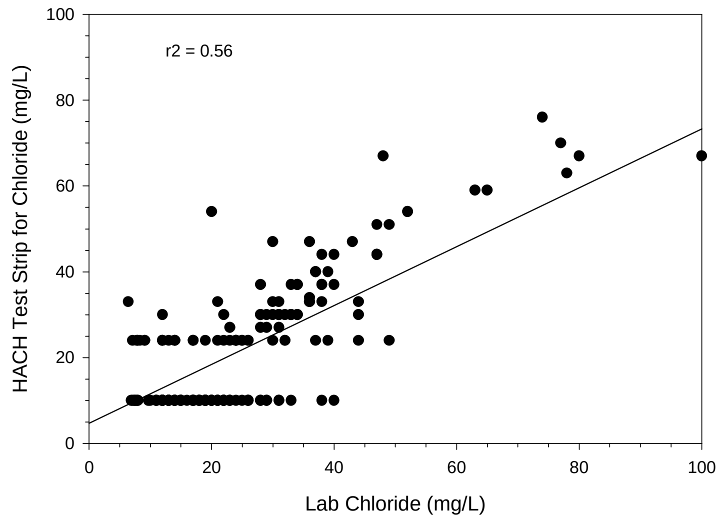


Figure 26. *Comparison of IOWATER and professional chloride data.*

Chloride values appear to match up closely with professionally obtained chloride concentrations.

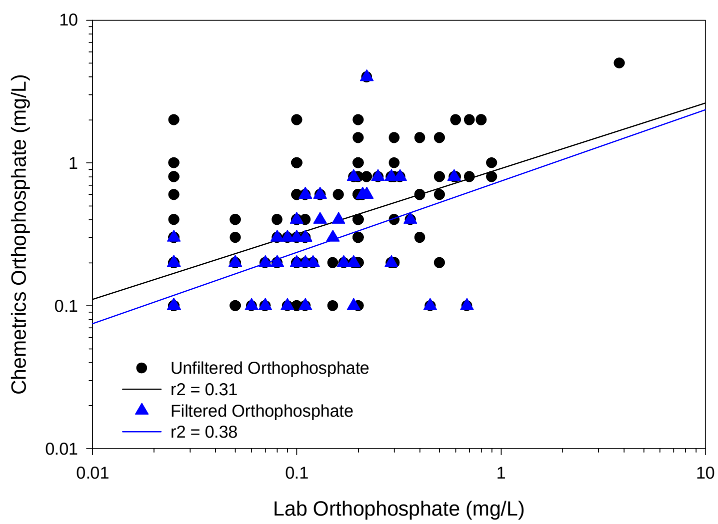


Figure 27. *Comparison of IOWATER and professional orthophosphate data.*

Since soil from the suspended load can make readings using the orthophosphorus color comparator difficult, side-by-side sampling is conducted using both unfiltered and filtered water samples. There seems to be less variability among filtered samples.

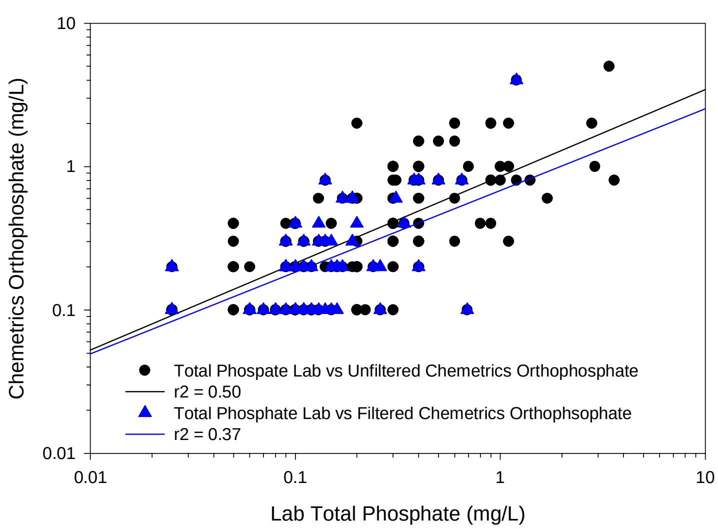


Figure 28. *Comparison of IOWATER orthophosphate and professional total phosphate as P.*

It is unknown why this relationship exists, but IOWATER methods for measuring orthophosphorus concentrations appear to be more closely tied with professional total phosphate as P concentrations. Limitations to IOWATER methods, namely color comparator scales, may provide clues to this phenomenon.

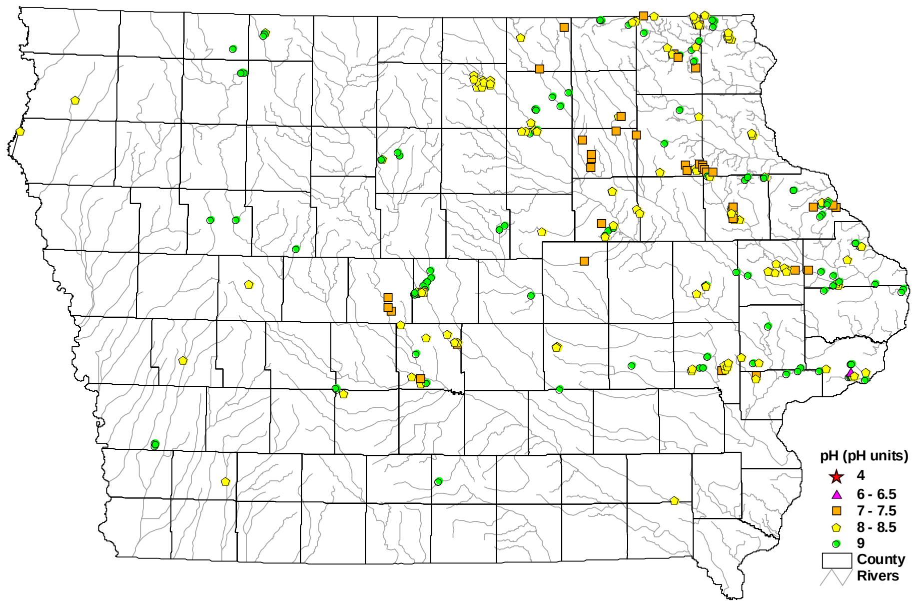


Figure 29. *2000 median pH values.*

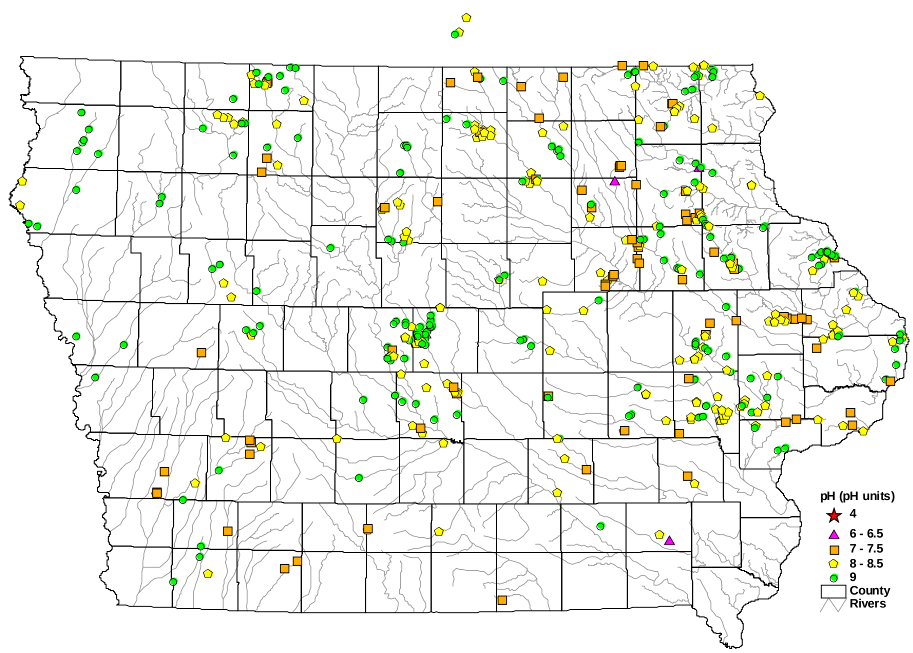


Figure 30. *2001 median pH values.*

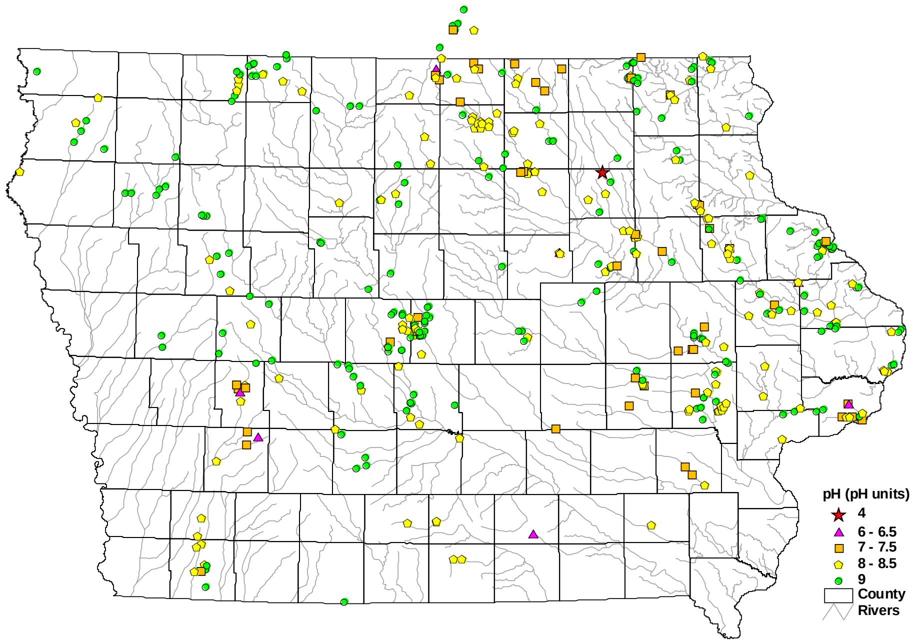


Figure 31. *2002 median pH values.*

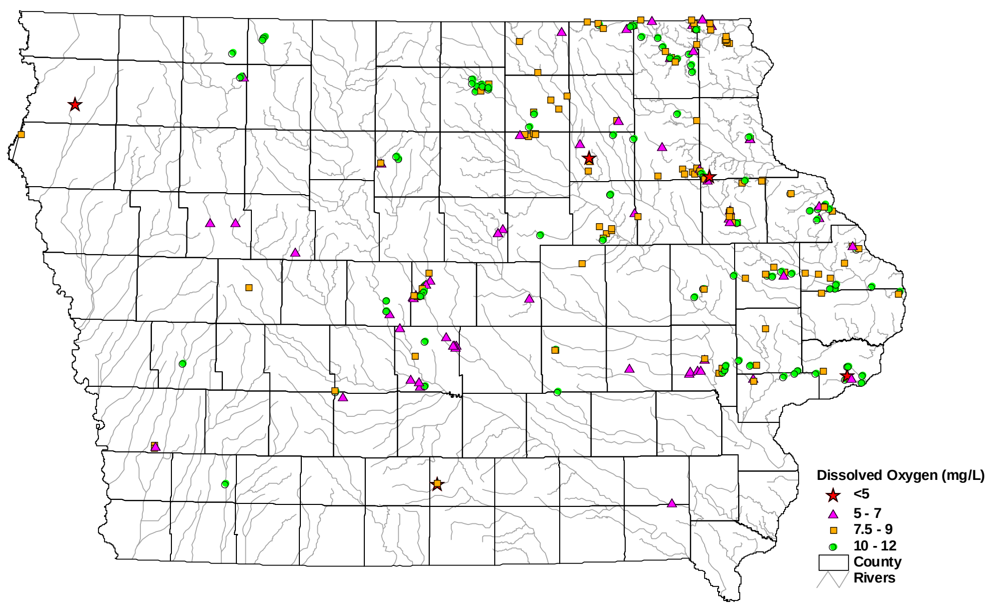


Figure 32. *2000 median dissolved oxygen concentrations.*

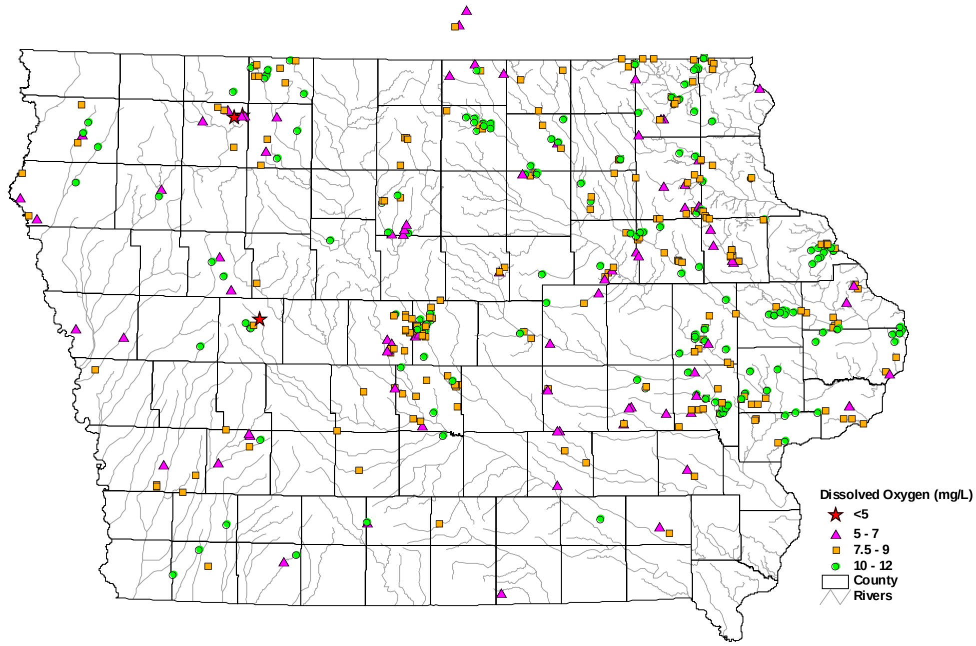


Figure 33. *2001 median dissolved oxygen concentrations.*

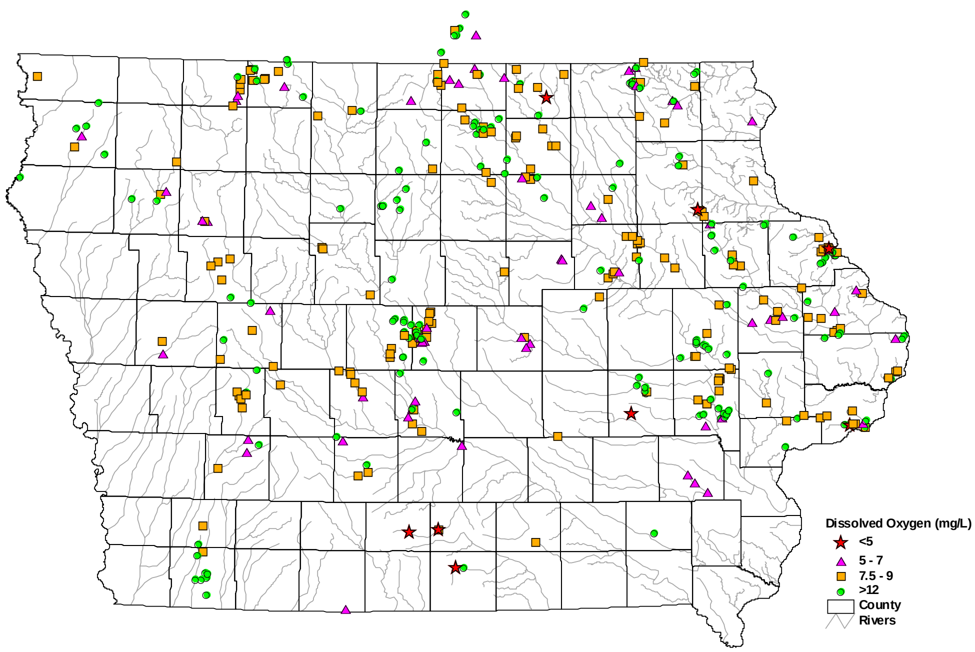


Figure 34. *2002 median dissolved oxygen concentrations.*

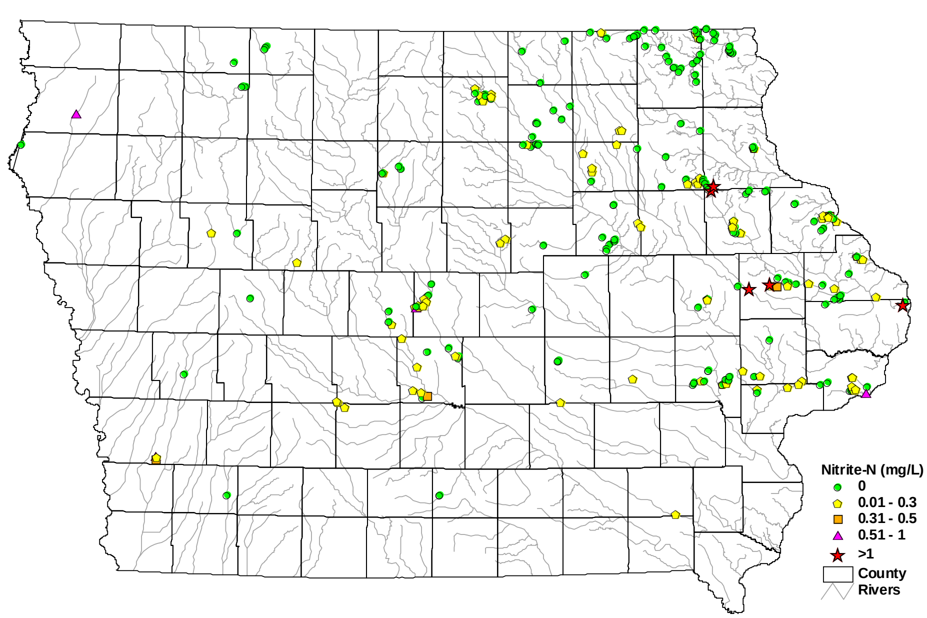


Figure 35. *2000 median nitrite-N concentrations.*

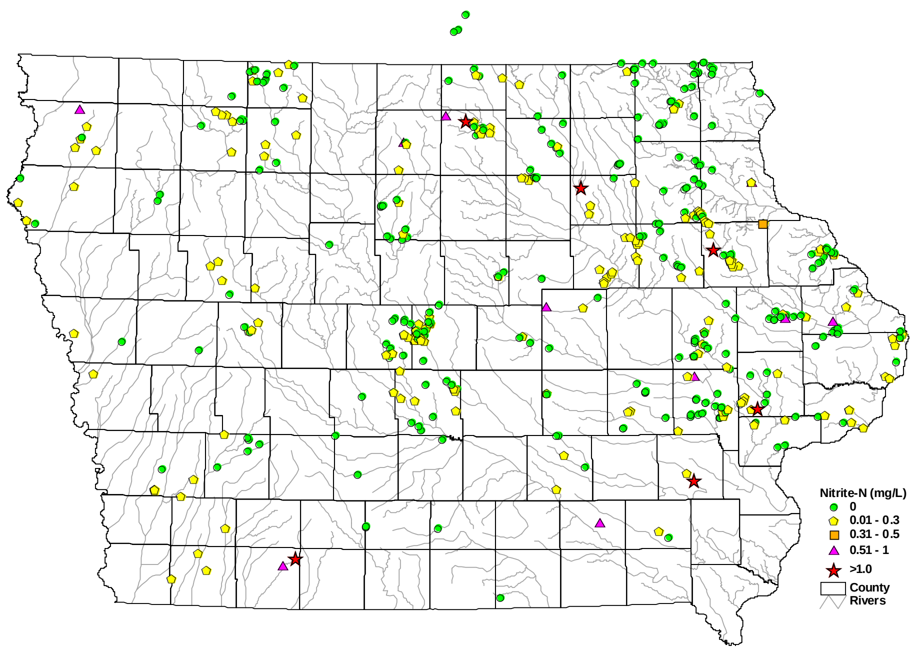


Figure 36. *2001 median nitrite-N concentrations.*

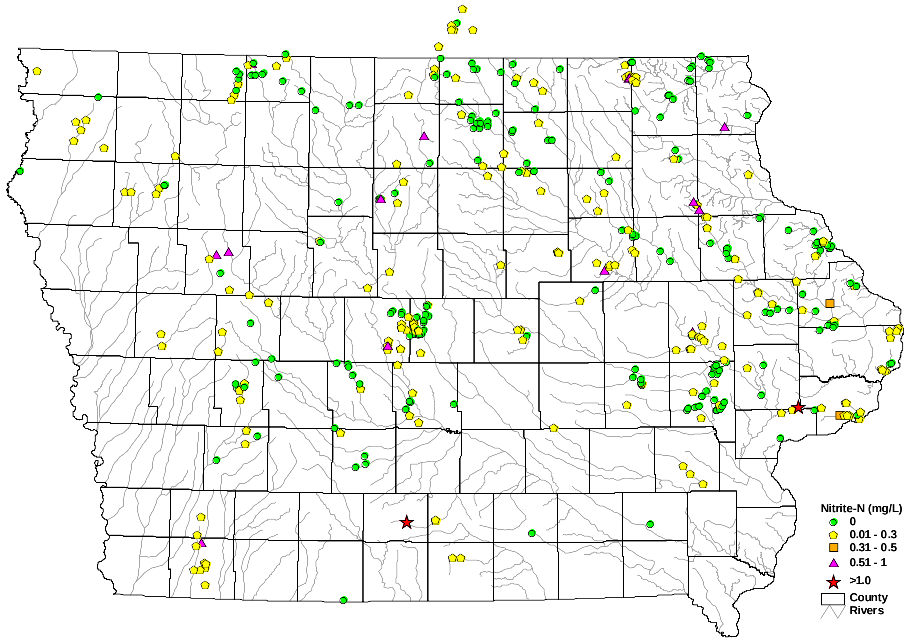


Figure 37. *2002 median nitrite-N concentrations.*

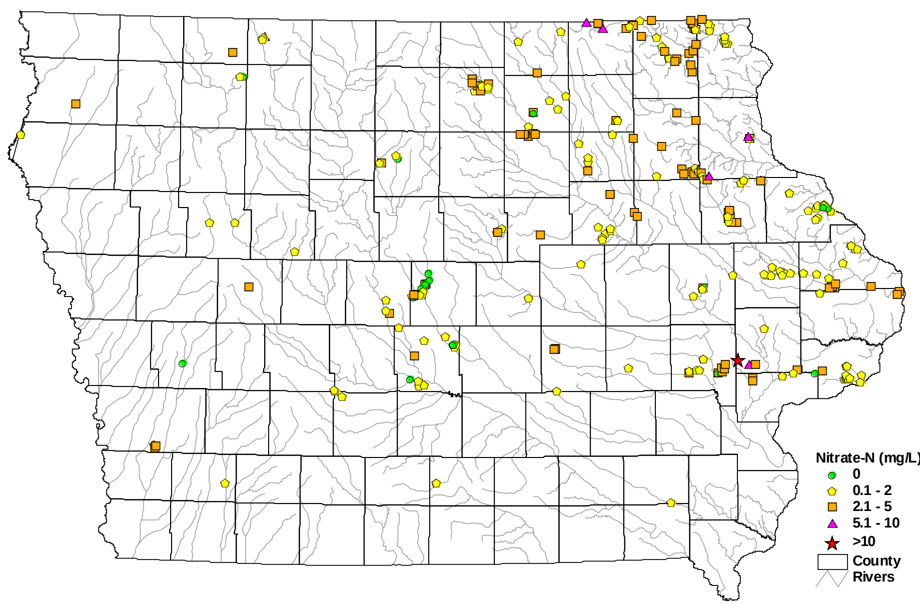


Figure 38. *2000 median nitrate-N concentrations.*

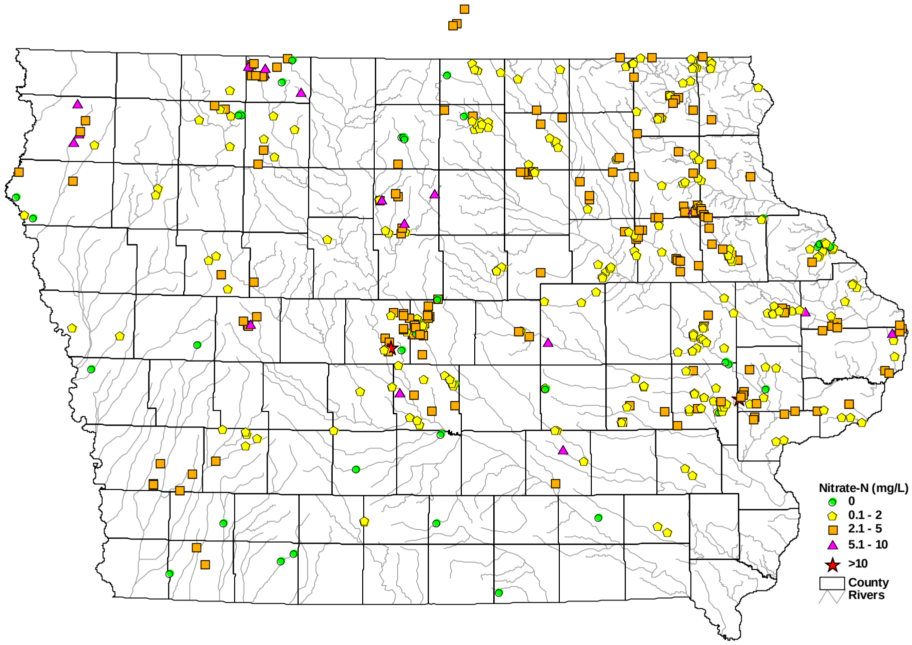


Figure 39. *2001 median nitrate-N concentrations.*

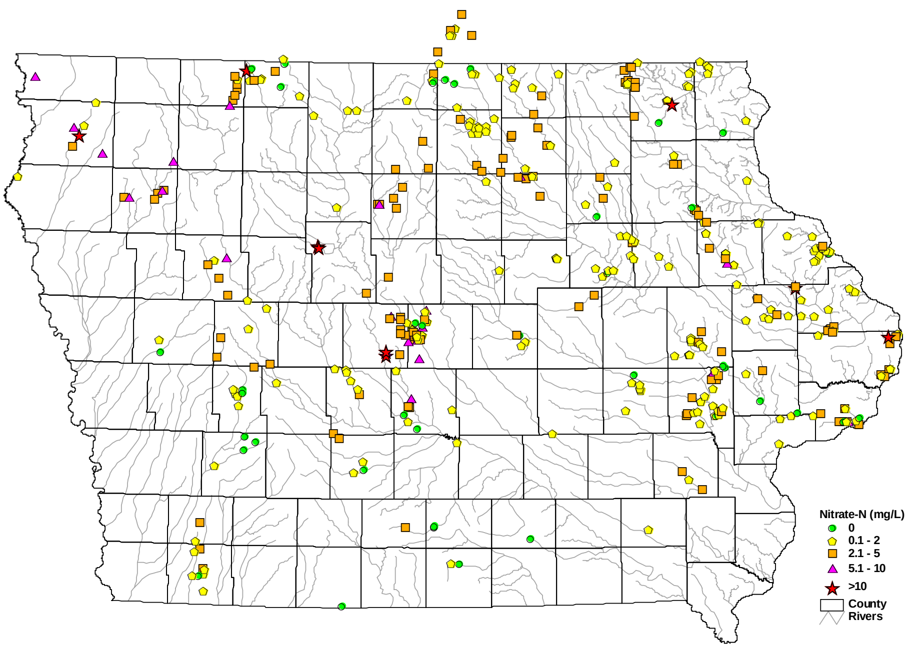


Figure 40. *2002 median nitrate-N concentrations.*

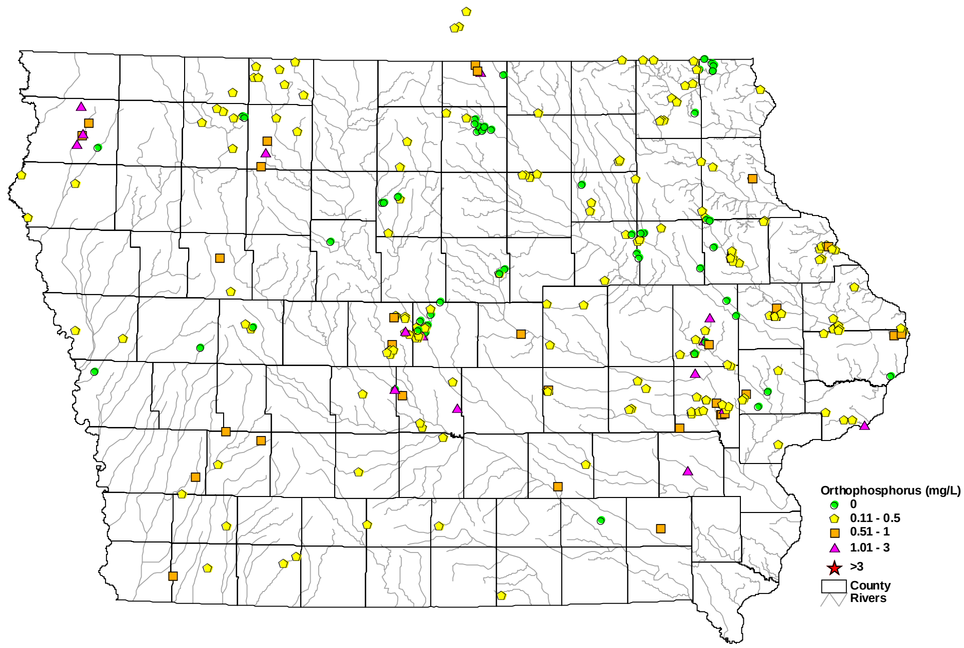


Figure 41. *2001 median orthophosphorus concentrations.*

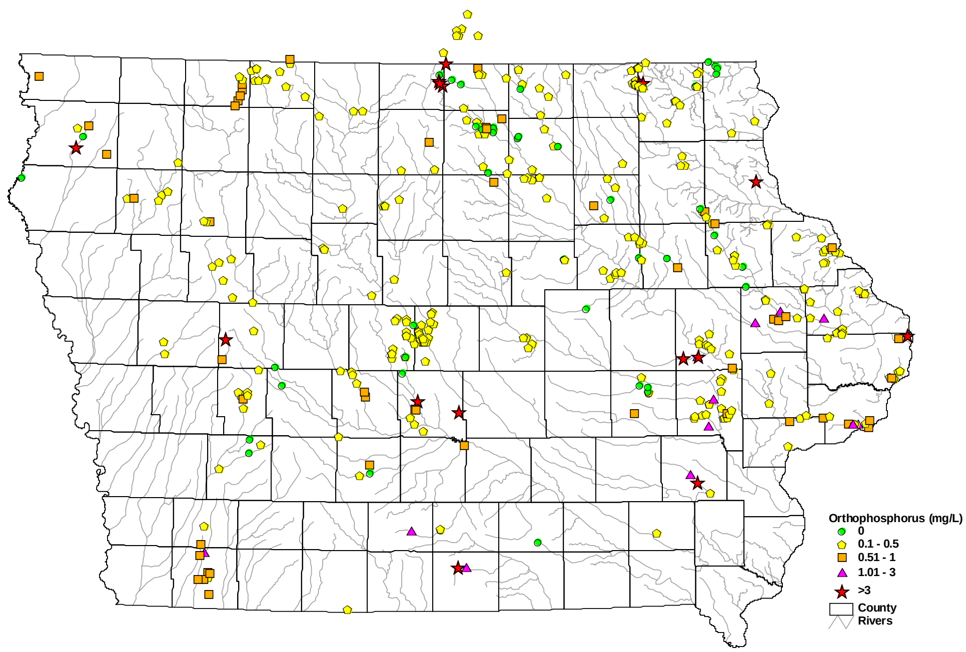


Figure 42. *2002 median orthophosphorus concentrations.*

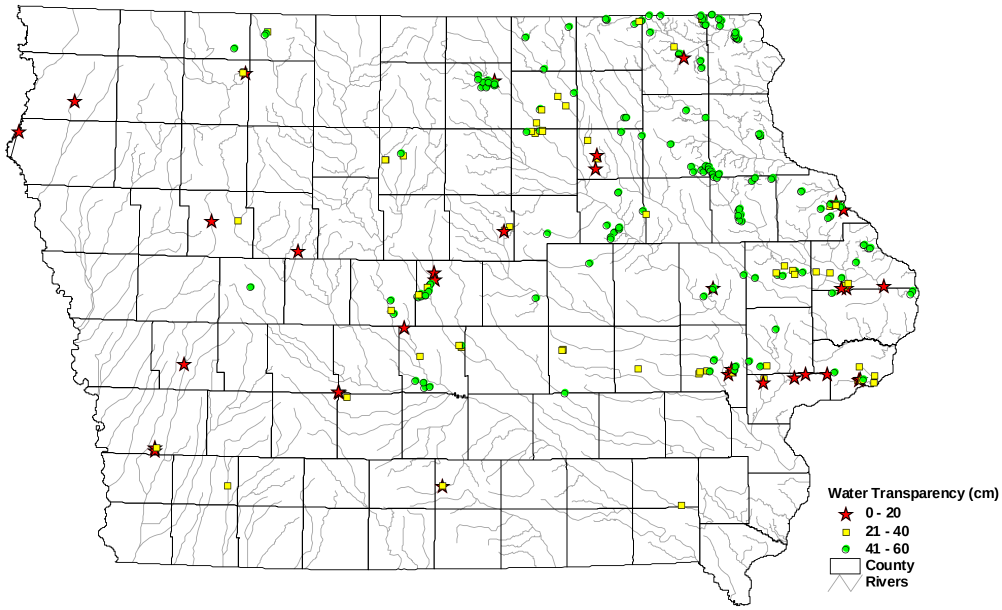


Figure 43. *2000 median water transparency readings.*

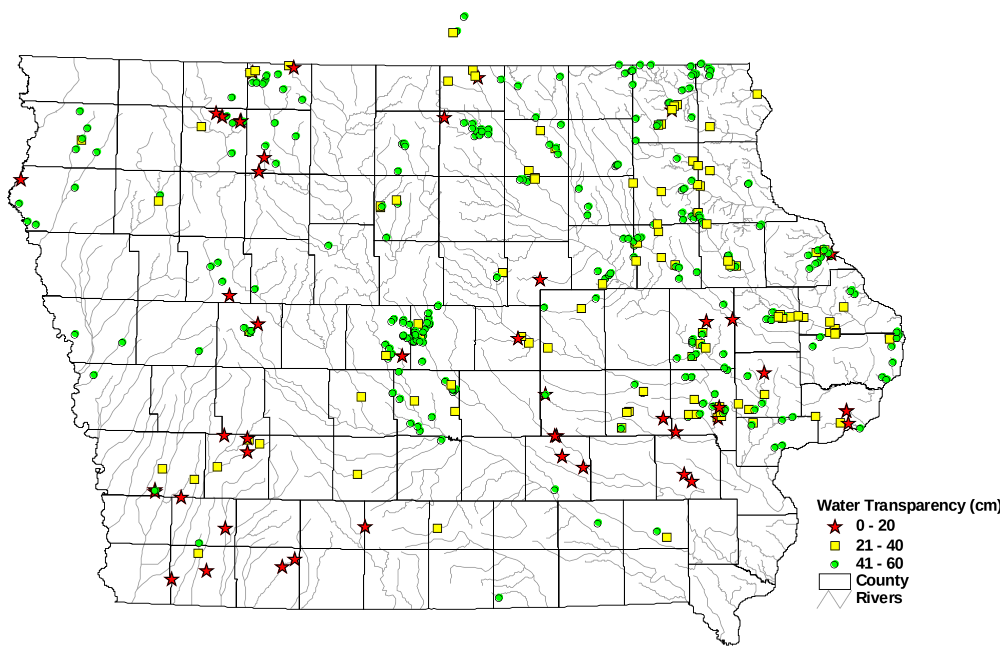


Figure 44. *2001 median water transparency readings.*

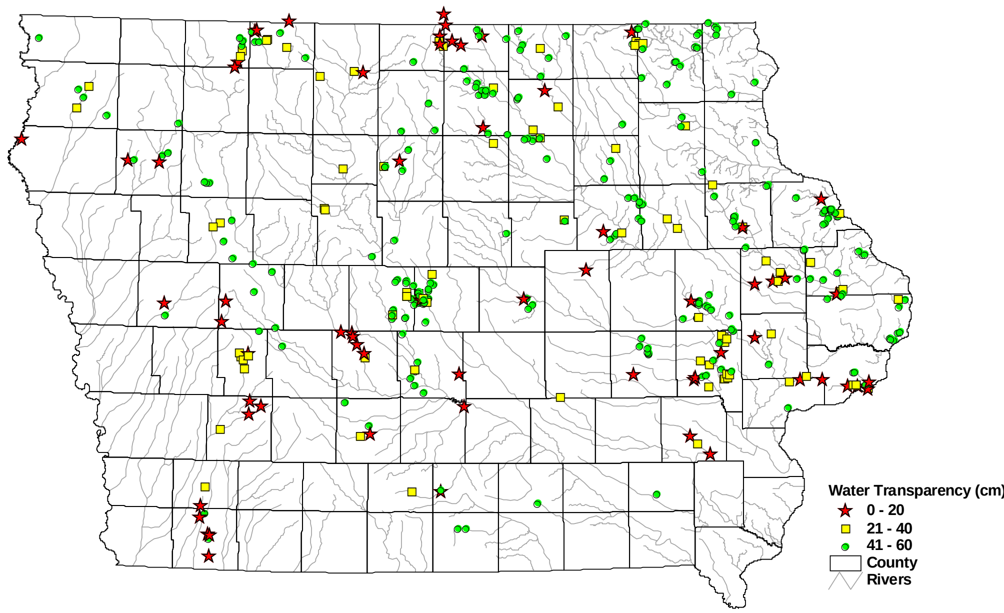


Figure 45. *2002 median water transparency readings.*

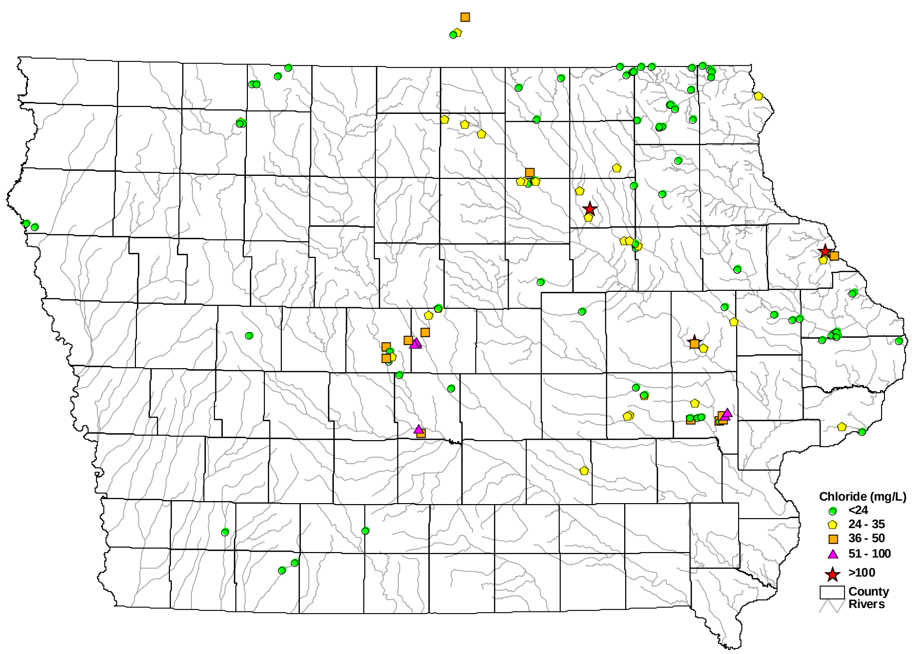


Figure 46. *2001 median median chloride concentrations.*

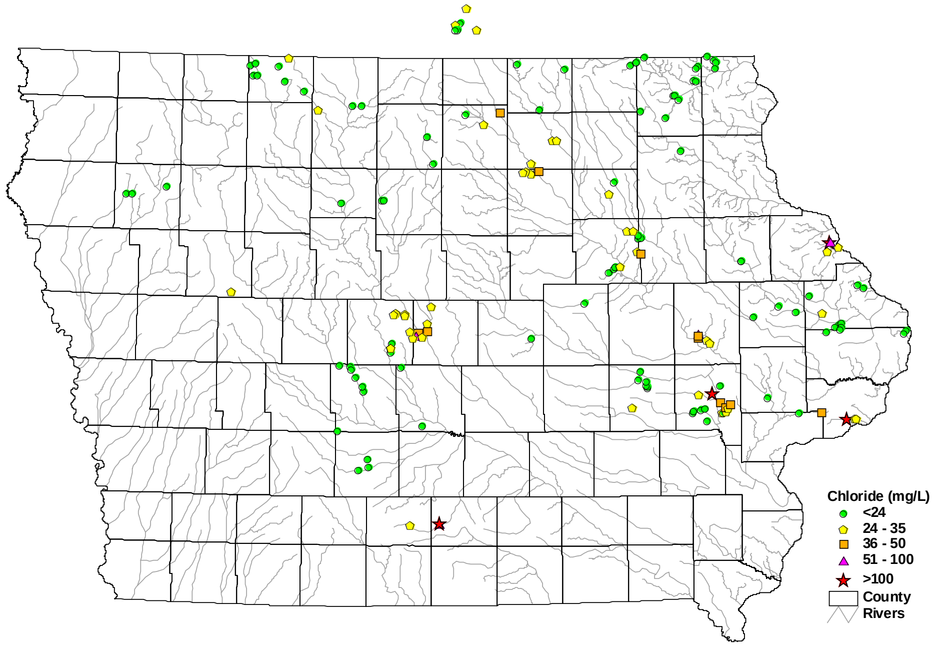


Figure 47. *2002 median median chloride concentrations.*

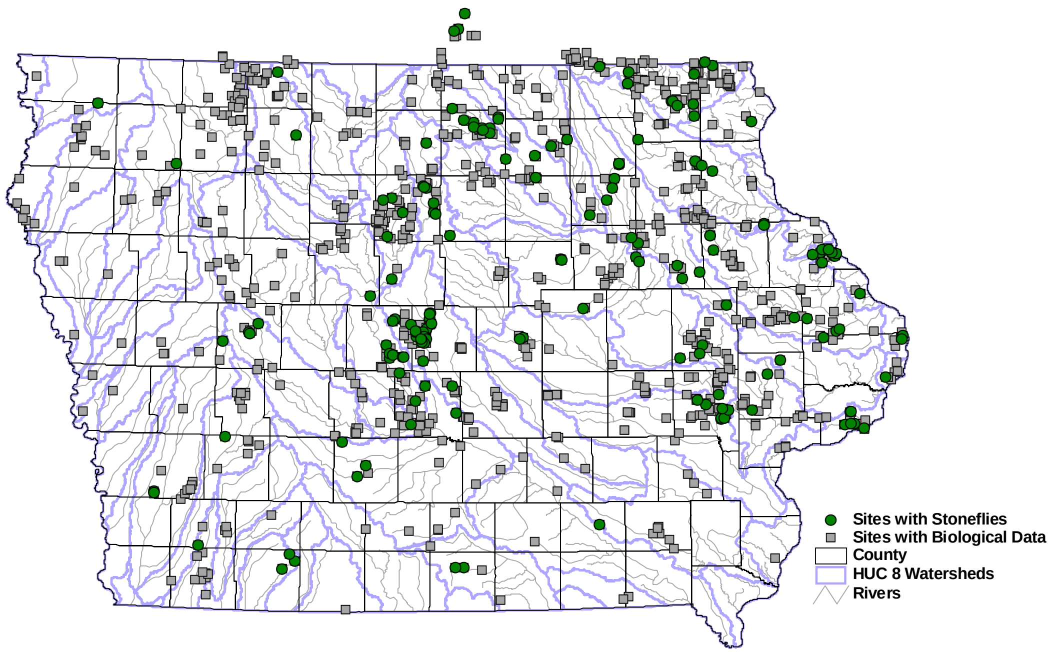


Figure 48. *IOWATER sites where stoneflies have been identified.*

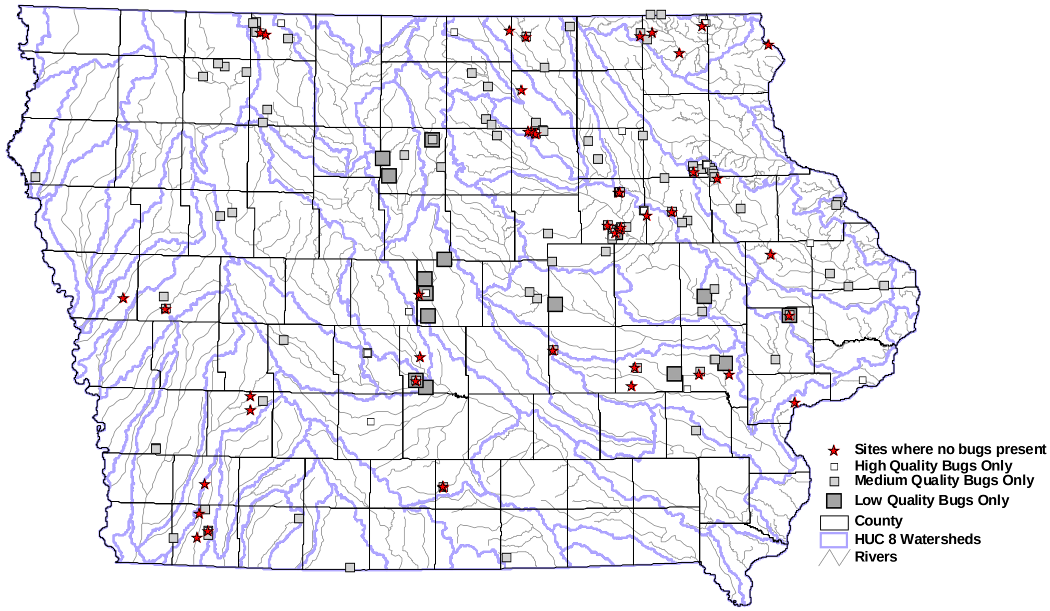


Figure 49. *IOWATER sites with uncharacteristic benthic macroinvertebrate diversity.*

Data From Biological Assessments

Stoneflies are generally considered to be very intolerant benthic macroinvertebrates. In other words, if pollution is present, these are usually the first organisms to disappear. Therefore, their distribution may be of particular importance. One thing to keep in mind, however, is that there are many different species of stoneflies and their pollution tolerance varies among species. Figure 48 shows the location of IOWATER sites where stoneflies have been identified by IOWATER Level 1 monitors.

There are quite a few sites in the IOWATER database that have very unique benthic macroinvertebrate data associated with them. A healthy stream should have healthy populations of high, middle, and low quality critters. Therefore, the sites that have just one category of benthics present may indicate that either something is going on in the stream, or the monitors aren't thoroughly sampling their monitoring site and benthic populations are being misrepresented (Figure 49). What may be most alarming about this data is that 58 of the 1,267 datasets recorded no benthic macroinvertebrates at all (Table 4). Comments from 10 of these sites specifically addressed this issue, and four sites had comments indicating that they were dry. Sites where benthics are absent, or where only low quality benthics are found, would be good candidates for areas that could use more in-depth monitoring.

Table 4. *Benthic macroinvertebrate diversity.*

Biological Data Sets	1,267
Sites With Only High Quality Critters	23
Sites With Only Middle Quality Critters	109
Sites With Only Low Quality Critters	23
Sites Where Benthic Macroinvertebrates Were Absent	58
Maximum Taxa Richness	23
Minimum Taxa Richness	0

Table 5. *2000-2002 IOWATER data.*

	Units	Count	Min	10th	25th	50th	75th	90th	Max
pH	pH units	3310	4	7	8	8	9	9	9
Dissolved Oxygen	mg/L	3190	1	6	8	8	10	12	12
Nitrite-N	mg/L	3211	0	0	0	0	0.15	0.15	3
Nitrate-N	mg/L	3267	0	0	1	2	5	5	50
Orthophosphorus	mg/L	2071	0	0	0.1	0.2	0.4	1	10
Chloride	mg/L	784	<24	<24	<24	<24	30	37	640
Water Temperature	°Fahrenheit	3175	0	40	50	59	68	75	95
Water Transparency	centimeters	3000	0	14	28	54	60	60	60

Count is the number of observations. Min is the minimum value observed. 10th, 25th, etc., represent percentiles of values. If values are ordered high to low, the 90th is the value which 90% of the samples fall below. Max is the maximum value observed.

Of all the benthics recorded as present at all of the sites, 26% were high quality, 50% were middle quality, and 24% were low quality. Overall, this is a typical proportion of benthic macroinvertebrates.

Conclusions

Table 5 shows the distribution of the data within the different parameter ranges. The lowest pH value recorded was 4 and 90% of the datasets recorded pH values of 7, 8, or 9. Only 10% of IOWATER sites had dissolved oxygen values less than 6 mg/L. Nitrite concentrations across the state appear to be relatively low – over 50% of the samples did not detect nitrite. Nitrate concentrations, on the other hand, were detected more often. Orthophosphorus concentrations were detected in 75% of the samples. The minimum detection concentration of 0.1 mg/L is already near the EPA proposed water quality standard for Iowa streams, which means there's some room for improvement here. Chloride concentrations appear to be relatively low, with only a few sites recording high concentrations. Water transparency as a whole appears to be pretty clear, with 50% of IOWATER sites having transparency values of 54 cm or greater.

Without long-term, continued monitoring, data obtained from IOWATER volunteers may have limited uses. For example, many IOWATER sites having median values that may (or may not) indicate cause for concern were only based on one sample taken within a given year. While these random, one-time samples provide a limited picture of water quality and overall health of these areas, a disadvantage is that they only provide information about a particular site at the particular time they are monitored. However, this data can be very useful when it is gathered at multiple sites throughout a watershed. The resulting data may pinpoint "hot spots," or isolate areas in need of further monitoring. Continued, long-term, consistent monitoring that results from these efforts can provide insight into watershed health.

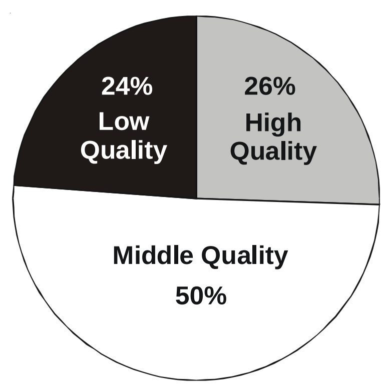


Figure 50. *Total proportion of benthic tolerances.*

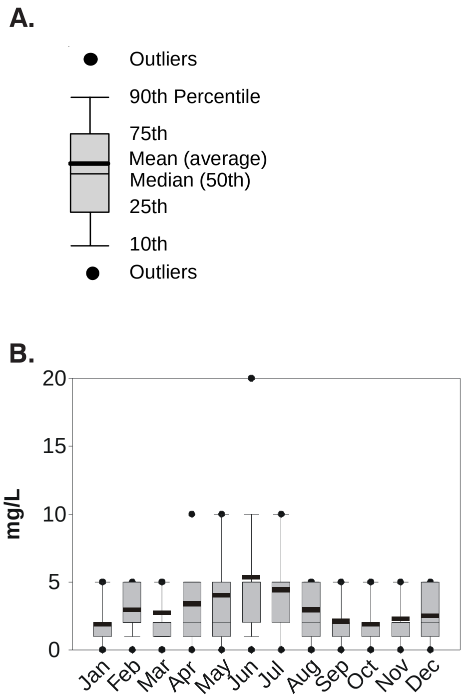


Figure 51. *Explanation of a box plot* (**A.**)*.Higher rainfall and runoff in the spring can cause nitrate-N levels to rise during these months* (**B.**).

Routine sampling is required for water quality assessments because many things can affect a one-time sample. For example, weather can have the largest single outside influence on water quality parameters. Weather determines an area's climate, which describes the average weather conditions over long periods of time. In other words, weather is happening all the time and constantly changing (step outside to observe the weather), and climate is a summary of the weather conditions (hot summers, frigid winters).

Figures 51 and 52 show the influence of seasonality on four water quality parameters. Elevated water temperatures during the summer result in lower dissolved oxygen in streams. Warmer water temperatures also encourage algae growth, lowering transparency. Sediments washed in during heavy spring and summer rainstorms decrease water clarity and absorb sunlight, further raising water temperatures.

Nitrate concentrations mirror rainfall patterns with higher levels coming during spring and fall. During the period 2000-2002, below normal precipitation resulted in lower median nitrate values.

Database Management

Although Iowa was not an early adopter of a statewide volunteer monitoring program, IOWATER benefited from the lessons learned by other volunteer water monitoring programs across the United States. Coordinators of other state volunteer water monitoring programs found management of volunteer data a time consuming endeavor, especially if the program coordinators were entering data into a central database. Access to data was another issue. Volunteers wanted to be able to see their data and to have their data available to others to use.

Since IOWATER had limited staff and resources at the time, it was decided to develop an online database to manage volunteer data. At the same time, the Water Monitoring Program staff was embarking on the development of IASTORET (the modern version of STORET – U.S. EPA's STOrage and RETrieval database), which the Iowa Department of Natural Resources planned on installing locally and customizing to meet the management needs of Iowa's water quality data. The eventual goal with the IOWATER database is to merge the IOWATER data into STORET.

The online database allows trained IOWATER monitors to use the Internet to submit data to a central database. IOWATER monitors are not required to submit their data. Use of the data is left up to the individual. Table 6 lists the estimated cost to develop and maintain the IOWATER database. IOWATER decided that individuals collecting the data were the most qualified to submit the data. The database, available at the IOWATER website (www.IOWATER.net), went online June 1, 2000. The database is password protected so that only trained IOWATER monitors can register monitoring sites and submit data. Anyone, however, can view the data. At Level 1 workshops, participants are trained to use the IOWATER database, not only to submit their data, but to access data submitted by other monitors throughout Iowa. Upon completion of a Level 1 workshop, each individual is given an IOWATER monitor ID and password that is used to register sites and submit data.

Accessing Water Quality Data

IOWATER Data

IOWATER data can be viewed by anyone who has internet access at www.iowater.net. Information in the IOWATER database can be queried in a number of ways including site name, county, or watershed. Once a site is selected, a site log appears that indicates the biological, chemical/physical, and habitat assessments, and photographs that are available. Assessments are listed by the date the assessment occurred, from the most recent to the oldest. If a site has multiple records available for a particular assessment, all records can be viewed at the same time by clicking on the colored header bar. To view all of the chemical/physical assessments at the same time, for example, click on the chemical/physical header bar (Figure 56). A window will open that displays all of the chemical/physical assessments submitted for this site. Currently, no graphing tool is available with the IOWATER database. The data can be graphed, however, by copying and pasting it into a spreadsheet program and utilizing available charting or graphing tools in the spreadsheet program.

ArcIMS™ is used to geographically display monitoring sites and access data. ArcIMS™ is an Internet mapping application that allows GIS (Geographic Information System) data to be delivered to an individual's desktop. It allows the user to identify information about different layers of geographically referenced data, such as IOWATER monitoring sites, watersheds, and designated uses for stream segments in Iowa, and to create a map based on the various layers of information one wants displayed (Figure 57). As one zooms in to an area of interest by using the "" button from the toolbar on the left, additional layers of information become visible. The user has the ability to make one layer of information "active," allowing information with that layer to be accessed. For example, make the IOWATER Sites layer active. Select "" or the Identify button from the toolbar. Click on any IOWATER site. Information for that site appears below the map. In the Detail Information column is a hyperlink that provides a direct link to the water quality data for this site.

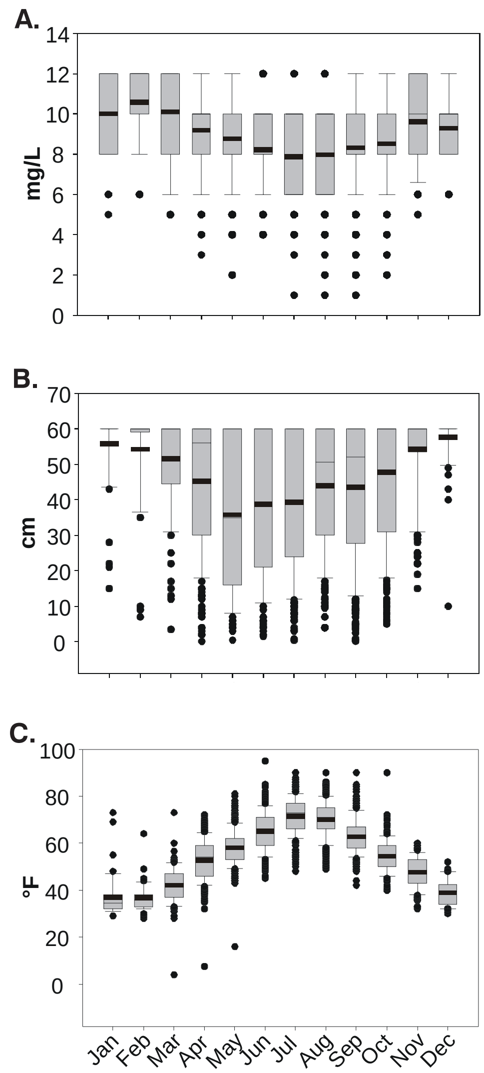


Figure 52. *Water temperature* (**C.**) *shares an inverse relationship with both dissolved oxygen* (**A.**) *and transparency* (**B.**).

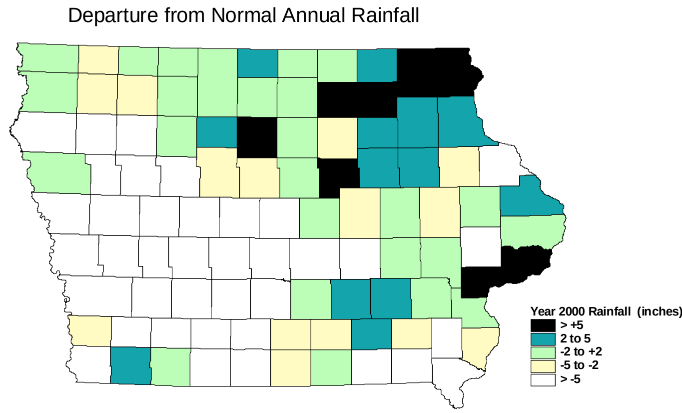


Figure 53. *In 2000, southwestern Iowa experienced dry conditions, while northeastern Iowa was slightly wetter than normal.*

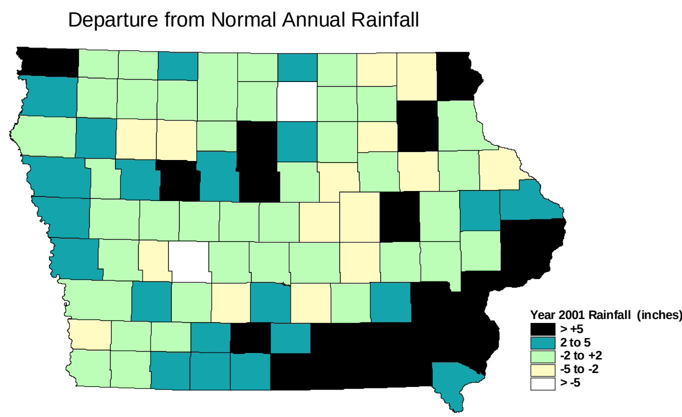


Figure 54. *In 2001, most of Iowa experienced normal rainfall, with the exception of southeastern Iowa.*

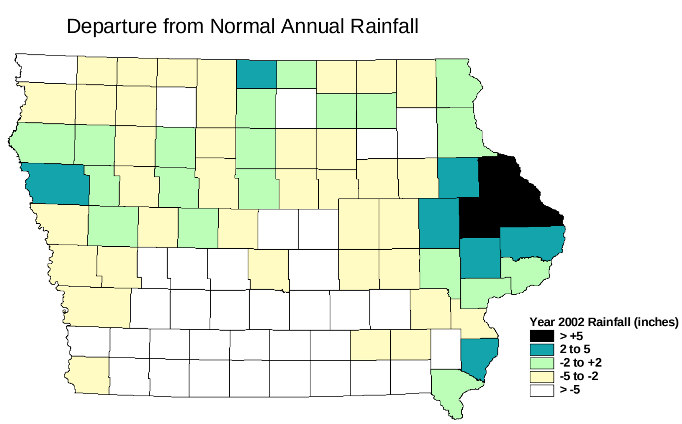


Figure 55. *2002 was an exceptionally dry year for Iowa.*

Table 6. *IOWATER database expenses.*

Items to develop database (staff time estimate - $25/hour)	**Estimated Cost**
3 full-time staff for 90 days to develop database tables and web interface for Level 1; includes online data submission forms, online site registration form; view data forms (2160 hours)	$54,000
Password protected database security form – modification of form off the web (5 hours)	$125
Development of Level 2 online data submission forms and view data forms (40 hours)	$1,000
Development of Level 2 modules – standing waters, benthic macroinvertebrate indexing, soil (90 hours)	$2,250
Iowa Geographic Image Map Server used by citizen monitors to identify UTM coordinates of monitoring sites	Priceless
Purchase of SQL server to house the IOWATER database	$5,000
Purchase of SQL software and associated SQL license (educational version)	$500
Purchase of web server	$3,500
Purchase of multiple copies of educational version of Front Page to develop web-based online forms ($80/license)	$240
Purchase of ArcIMS software	$7,500
Development of ArcIMS application for IOWATER (120 hours)	$3,000
Registration of IOWATER website (www.IOWATER.net)	$35
One-time installation of IOWATER home page on commercial site	$75
Initial placement of www.IOWATER.net on commercial site for one year	$220
Development of Netscape View Option for IOWATER database (20 hours)	$500
TOTAL	***$77,945***
Maintenance to the database	**Estimated time for staff**
Maintenance to database	1 hour per week
Adding new IOWATER site monitors (# of workshops varies)	1 hour per workshop
Registering new IOWATER monitoring sites (# of sites varies)	0.5 hour per site
Provide training at IOWATER workshops on how to use the database (# of workshops varies)	1 hour per workshop
Development of online field forms for additional modules	30 hours per module
Renewal of IOWATER website name (www.IOWATER.net)	$55 for 5 years
Maintenance of www.IOWATER.net on commercial site	$250 per year
Monthly SQL server fee for IOWATER database on a commercial site	$85 per month

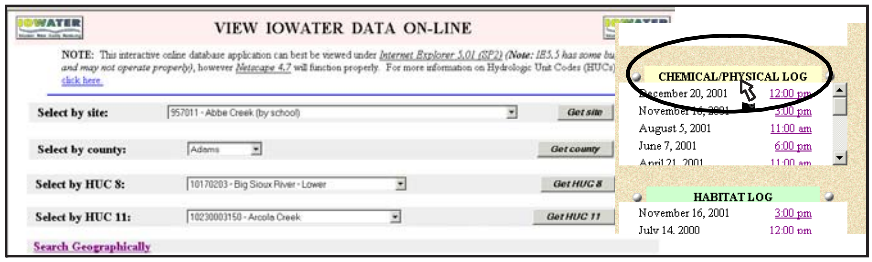


Figure 56. *Accessing IOWATER data using the internet.*

Professional Water Monitoring Data

Iowa's Water, the State's professional water monitoring program, stores all of its data, as well as data from other sources in what is known as Iowa STORET, located on the Web at www.igsb.uiowa.edu/water. Here, data from various monitoring projects can be viewed, parameters of interest may be selected, and graphs may be produced. All of this can be done from this site. In the near future, IOWATER data will take its place at the table in the wonderful world of STORET.

IOWATER SNAPSHOT SAMPLING

Results from Snapshot Samplings in Iowa: The Strength of Volunteers

During 2002, snapshot samplings were conducted in three locations across Iowa to assess water quality in selected areas. A snapshot sampling is when multiple sites throughout a geographic area, such as a watershed or county, are sampled within a short period of time (e.g., three hours). A snapshot provides a picture of water quality at one point in time. Snapshot samplings can be completed:

- To increase public awareness and involve the local community in water quality issues;
- To collect baseline data for a geographic area; and
- As a screening tool for identifying "hot spots" or streams that may contribute elevated concentrations of nitrate or other parameter of interest.

The samplings can be done:

- To learn more about various parameters of interest (i.e., sediment, nutrients);
- Using a combination of physical, chemical, and biological parameters, as well as observations about stream condition; and
- During different times of the year or different flow conditions (e.g., low-flow sampling during the fall may allow identification of

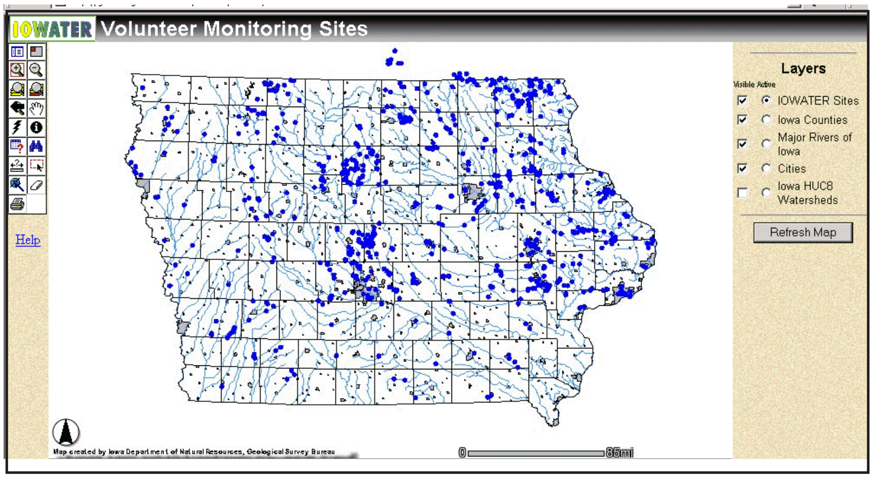


Figure 57. *IOWATER's ArcIMS application.*

septic system inputs that otherwise would not be as apparent under higher flow conditions).

Each snapshot sampling was tailored to address the water quality issue(s) of interest in that particular area. Local organizers identified the parameters to test for and the location and number of sites to monitor. Excess sediment in streams is a concern in Whitebreast Creek Watershed, so several parameters were selected to measure sediment. Scott County contains a large urban area, so several parameters targeted potential urban contaminants such as oil and grease. Most of the snapshots utilized both field and lab test methods. Field tests were performed using IOWATER methods, with testing equipment donated by the IOWATER Program. Lab analyses were performed by the University of Iowa Hygienic Lab, with the cost for these analyses covered by Iowa's Water Monitoring Program. The City of Davenport's Water Pollution Control Plant Lab also donated some lab analyses in conjunction with the Scott County sampling.

Volunteers are key to the success of any snapshot sampling. Depending on the number of sites to be sampled and the geographic area to be covered, the enlistment of volunteers is crucial. IOWATER volunteers, as well as numerous teachers and students, were involved in each of the snapshot samplings. A training session for volunteers, held prior to each snapshot, covered: logistics for the day of sampling; instructions on using the field testing equipment; proper completion of the field assessment form; and collection of samples for lab analysis.

The following section summarizes results from three snapshot samplings conducted across Iowa during 2002: Scott County, Muscatine County, and Whitebreast Creek Watershed (Figure 58).

Figure 58. *Location of Whitebreast Creek Watershed, Scott County, and Muscatine County snapshot samplings that were conducted in 2002.*

Scott County Snapshot

Historically, the streams in and around the cities of Davenport and Bettendorf have been monitored on a regular basis, thanks to the City of Davenport's Water Pollution Control Agency. The Davenport Water Pollution Control Agency has monitored close to 50 sites in and around the Quad Cities since the mid 1970s for a variety of chemical parameters. While this long-term monitoring provided valuable data to evaluate trends in water quality for urban streams, what was missing was a picture of water quality throughout all of Scott County, including rural streams. In September 2001, a coalition of local, city, and county officials, as well as local educators and interested citizens (many of whom were members of the Partners of Scott County Watersheds) began organizing the first snapshot sampling for Scott County that was held May 21, 2002. A total of 81 sites were monitored throughout Scott County with the help of IOWATER volunteers and many others (Figure 59). The long-term monitoring sites of Davenport's Water Pollution Control Agency were included, with an additional 40 sites, primarily targeting streams in the rural portions of Scott County.

Building on the success of the first snapshot sampling, the coalition decided to conduct the countywide snapshots on a biannual basis, both during the spring under higher flow conditions and again in the fall under lower flow conditions. On October 7, 2002, Scott County

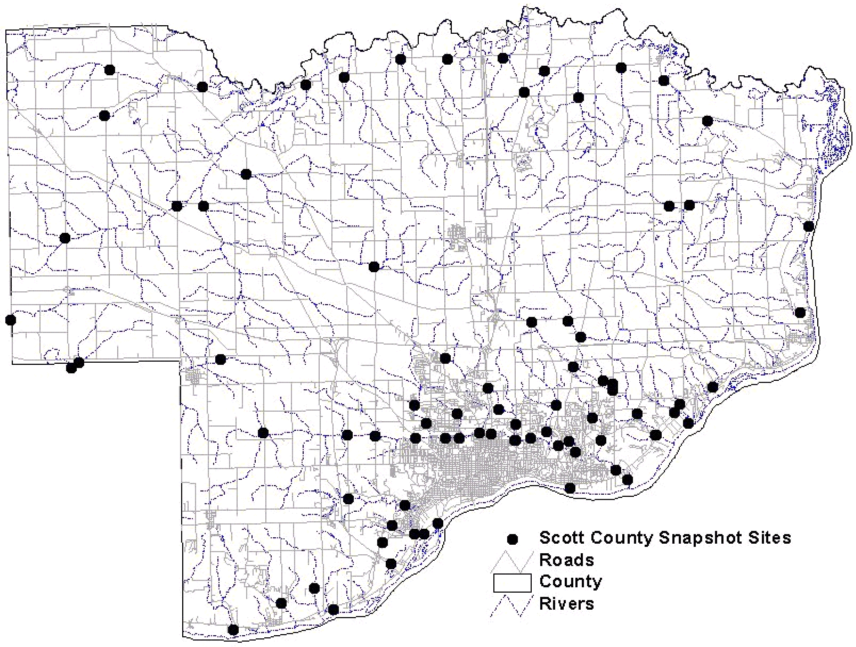


Figure 59. *Sites monitored as part of the Scott County Snapshot Sampling.*

completed its second snapshot sampling. Table 7 summarizes the results from both samplings. All 81 sites sampled in May were again sampled in October, with the addition of one urban site.

For both samplings, the long-term Davenport Water Pollution Control Agency sites were also tested for pesticides and total extractable hydrocarbons (oil and grease) to determine what pesticides were present in an urban setting and the levels of hydrocarbons present from parking lot and street runoff. Area high school teachers and students also conducted biological monitoring at several of these long-term sites, and this represented some of the only biological monitoring that has occurred at these sites.

So what were the results? There were noticeable differences between the May and October snapshot results. Dissolved oxygen concentrations were slightly higher in May while water temperatures were cooler. Overall, water transparency was similar, although transparency increased for some sites from May to October while others decreased. Higher orthophosphorus and chloride concentrations were reported for the October snapshot. For most sites, fecal coliform bacteria and total suspended solids were higher in October. Some of the high fecal coliform bacteria results occurred in the urban area, and may indicate inputs from urban septic systems for homes not connected to city sewer. Total extractable hydrocarbons were detected at 95% of the sites in October compared to 20% of the sites in May. Concentrations of total extractable hydrocarbons were also higher in October. In terms of pesticides, atrazine was the most frequently detected pesticide and was present in 95% of the May samples and 90% of the October samples. Two of atrazine's breakdown products, or metabolites, were also detected during both samplings, with desethyl atrazine more frequently detected than desisopropyl atrazine. Metolachlor was also detected in both May and October. For those pesticides that were detected in both May and October, concentrations were higher in May. There were some differences in the types of pesticides detected. The May samples had detections of trifluralin and acetochlor, while October had detections of diazinon and bromacil.

Analysis of the May and October data continues and will include determination of whether the May data is statistically different from the October data, and if so, did concentrations increase, decrease, or remain relatively unchanged from May to October for different parameters. Results from Scott County will also be compared to results from Muscatine County, which is located adjacent to Scott County. The Scott County and Muscatine County snapshots were conducted within one week of each other.

Whitebreast Creek Watershed Snapshot

Whitebreast Creek Watershed is a 427 mi^2 watershed located in Warren, Clarke, Lucas, and Marion counties in south-central Iowa, and has been the site of a watershed project since 2001. Sediment is one of the primary pollutants of concern throughout the watershed, and the snapshot sampling was intended to collect baseline data throughout the watershed as well as identify subwatersheds where best management practices could be better targeted.

A total of 73 sites were initially identified for the snapshot sampling. Lack of precipitation in this area during late summer/early fall caused many of the sites to be dry; as a result, only 38 sites were sampled on September 7, 2002. Figure 60 shows the location of the 38 sites. Of the 38 sites sampled, a subset of 15 sites were also tested for pesticides. These 15 sites were located on selected subwatersheds and along the main stem of Whitebreast Creek.

Table 8 summarizes the results from the sampling. Nitrate-N concentrations were quite low throughout the entire watershed, with 75% of the samples reporting nitrate-N concentrations of 1 mg/L or less. The low nitrate-N concentrations are likely the result of dry conditions in the watershed. A site on Whitebreast Creek near Knoxville at the northeast corner of the watershed (at the lower end of the watershed) has been monitored on a monthly basis since October 1999 as part of

Table 7. *Scott County Snapshot Sampling results – May 21 and October 8, 2002 (the May results are the gray shaded rows; October results are the unshaded rows.*

	Unit	Method	# of samples	Min Value	Percentiles			Max Value	% Detection
					25th	50th	75th		
Water Temperature	degrees F	Thermometer - Field	77	44	48	50	51	77	
			79	50	53	55	58	65	
pH	pH units	IOWATER test strip & field meter	80	4.8	7.3	8.5	9	9.3	
			80	6.5	7	7.5	7.9	9.3	
Dissolved Oxygen	mg/L	IOWATER field kit & field meter	81	5.1	7.6	10	11.4	15.7	
			80	1	8	8.7	10	13.6	
Nitrite-N	mg/L	IOWATER test strip	81	0	0	0	0.05	3.0	
			77	0	0	0	0.2	1.0	
Nitrate-N	mg/L	IOWATER test strip	81	0	2	5	5	10	
			80	0	1	2	2	10	
Orthophosphorus	mg/L	IOWATER field kit	81	0	0.1	0.2	0.2	0.6	
			80	0	0.2	0.3	0.5	2.0	
Chloride	mg/L	IOWATER test strip	73	<22	<22	24	34	321	
			62	<24	29.5	48	70	363	
Transparency**	centimeters	IOWATER transparency tube	40	8	27	35	49	60	
			38	11	19	28	58	60	
Total Alkalinity**	mg/L	IOWATER test strip	NA	NA	NA	NA	NA	NA	
			38	80	120	180	225	240	
Fecal Bacteria	CFU/100 ml	Lab Analysis	81	<10	73	220	600	7000	
			80	<10	488	700	1100	9500	
E. coli Bacteria	CFU/100 ml	Lab Analysis	68	100	300	500	853	4640	
Volatile Total Suspended Solids*	%	Lab Analysis	41	0	2	5	9	22	
			42	0	13.4	23.1	44.7	100	
Chemical Oxygen Demand*	mg/L	Lab Analysis	39	0	7	15	22	38	
			42	12.6	22.4	25.2	32.0	61.1	
Total Suspended Solids*	mg/L	Lab Analysis	41	0	16	27	36	78	
			42	1.0	12.3	24.5	41.0	1480	
Atrazine*	µg/L	Lab Analysis	41	<0.10	0.21	0.42	0.57	3.20	95%
			42	<0.05	0.06	0.1	0.11	0.2	90%
Metolachlor*	µg/L	Lab Analysis	41	<0.10	<0.10	0.14	0.20	1.30	66%
			42	<0.05	<0.05	<0.05	<0.05	0.27	12%
Desethyl Atrazine*	µg/L	Lab Analysis	41	<0.10	<0.10	<0.10	0.16	0.44	77%
			42	<0.05	0.06	0.08	0.11	0.15	90%
Desisopropyl Atrazine*	µg/L	Lab Analysis	41	<0.10	<0.10	<0.10	<0.10	0.36	2%
			42	<0.05	<0.05	<0.05	<0.05	0.15	2%
Trifluralin*	µg/L	Lab Analysis	41	<0.1	<0.1	<0.1	<0.1	5.1	5%
			42	<0.05	<0.05	<0.05	<0.05	<0.05	0%
Acetochlor*	µg/L	Lab Analysis	41	<0.1	<0.1	<0.1	0.16	3.6	49%
			42	<0.05	<0.05	<0.05	<0.05	<0.05	0%
Diazinon*	µg/L	Lab Analysis	41	<0.1	<0.1	<0.1	<0.1	<0.1	0%
			42	<0.05	<0.05	<0.05	<0.05	0.23	12%
Bromacil*	µg/L	Lab Analysis	41	<0.1	<0.1	<0.1	<0.1	<0.1	0%
			42	<0.05	<0.05	<0.05	<0.05	1.3	2%
Total Extractable Hydrocarbons (Oil and Grease)	µg/L	Lab Analysis	41	<100	<100	<100	<100	180	20%
			42	<100	120	140	158	1300	95%

NA - Not Applicable; CFU/100 ml = Colony Forming Units per 100 milliliters of water
* Parameter measured at Davenport Water Pollution Control long-term sites only.
** Parameter measured at non-Davenport Water Pollution Control long-term sites only.
The following pesticides were also analyzed at the 41 Davenport Water Pollution Control long-term sites in May 2002, however, no detections were reported: cyanazine, alachlor, metribuzin, butylate. The following pesticides were also analyzed at the 42 Davenport Water Pollution Control long-term sites in October 2002, however, no detections were reported: cyanazine, alachlor, metribuzin, butylate, trifluralin, acetochlor, simazine, ametryn, EPTC, prometon, propachlor, propazine, and dimethenamid.

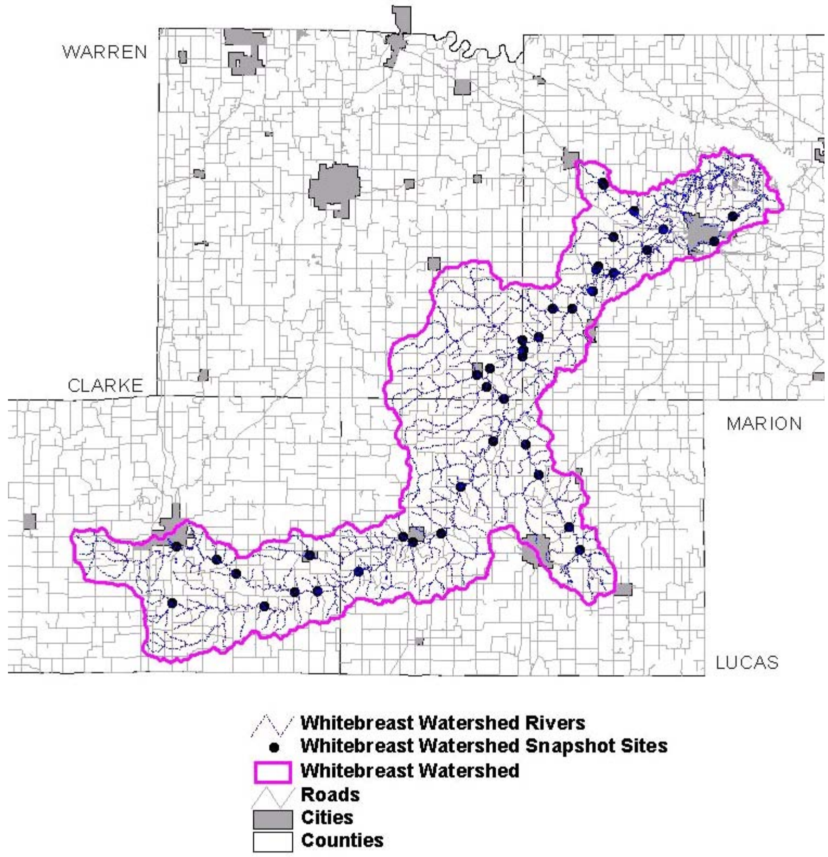


Figure 60. *Sites monitored as part of the Whitebreast Creek Watershed Snapshot Sampling.*

a statewide network. Nitrate-N results from the snapshot sampling were comparable to concentrations from the long-term monitoring site on Whitebreast Creek. Nitrate-N results from the snapshot sampling, however, were lower than levels reported from a statewide network of 80+ stream sites sampled in September.

Several sites located on the main stem of Whitebreast Creek in the upper part of the watershed all reported chloride concentrations >100 mg/L; the statewide average chloride concentration in streams year round is 18.3 mg/L. The elevated chloride levels in the upper part of the watershed may reflect direct inputs from livestock, failing septic system inputs, and/or discharge from municipal wastewater facilities, all of which could contribute elevated chloride to a stream. Chloride concentrations from the snapshot sampling were more variable than both chloride levels from the long-term monitoring site on Whitebreast Creek near Knoxville and chloride concentrations reported from a statewide network of 80+ stream sites sampled in September.

Table 8. *Whitebreast Creek Watershed Snapshot Sampling results – September 7, 2002.*

	Unit	Method	# of samples	Min Value	Percentiles			Max Value	% Detection
					25th	50th	75th		
Water Temperature	degrees F	Thermometer - Field	38	66	72	74.5	78	87	
Nitrite-N	mg/L	IOWATER test strip	38	0	0	0	0.15	1.5	
Nitrate-N	mg/L	IOWATER test strip	38	0	0	0.75	1	20	
Orthophosphorus	mg/L	IOWATER Field Kit	36	0	0.1	0.25	0.43	9.0	
Total Phosphorus	mg/L	Lab Analysis	38	<0.05	0.11	0.18	0.23	3.5	
Chloride	mg/L	IOWATER test strip	37	<24	<24	<24	154	391	
Transparency	centimeters	IOWATER transparency tube	38	<1	10	12	20	60	
Fecal Bacteria	CFU/100 ml	Lab Analysis	36	10	228	400	808	2200	
Total Suspended Solids	mg/L	Lab Analysis	38	3	34	58	91	240	
Atrazine	µg/L	Lab Analysis	15	0.23	0.45	0.55	1.3	1.9	100%
Metolachlor	µg/L	Lab Analysis	15	<0.05	<0.05	<0.05	<0.05	0.22	7%
Desethyl Atrazine	µg/L	Lab Analysis	15	0.14	0.19	0.31	0.47	0.52	100%
Desisopropyl Atrazine	µg/L	Lab Analysis	15	<0.05	<0.05	<0.05	0.20	0.31	40%
Prometon	µg/L	Lab Analysis	15	<0.05	<0.05	<0.05	<0.05	0.18	13%

CFU/100 ml = Colony Forming Units per 100 milliliters of water
The following pesticides were also analyzed at the 15 sites, however, no detections were reported: cyanazine, alachlor, metribuzin, butylate, trifluralin, and acetochlor.

Total phosphorus levels from the snapshot were similar to the long-term site on Whitebreast Creek and statewide concentrations from September 2002. Water transparency was low relative to the Scott County and Muscatine County snapshot samplings. Approximately 75% of the samples from Whitebreast Creek watershed reported transparency of 20 centimeters or less. Elevated total suspended solids concentrations also supported the low transparency readings. The average total suspended solids concentration from the snapshot sampling was 58 mg/L, higher than the average for the long-term monthly monitoring site on Whitebreast Creek (32 mg/L) and higher than what was reported statewide during the month of September (35 mg/L). Fecal coliform bacteria levels from the snapshot were also higher (average of 400 CFU/100 ml) than levels at either the long-term monitoring site on Whitebreast Creek near Knoxville (140 CFU/100 ml) or the statewide sampling conducted during September (110 CFU/100 ml). The presence of fecal coliform bacteria suggests a relatively fresh source of human and animal waste. Atrazine and desethyl atrazine were the most commonly detected pesticides in samples from Whitebreast Creek Watershed – they were detected in 100% of the samples. Also detected, but at a lower frequency, were desisopropyl atrazine, metolachlor, and prometon.

The sites in Whitebreast Creek Watershed will be sampled again in April 2003. Results from the April 2003 sampling will provide a picture of water quality under higher flow conditions.

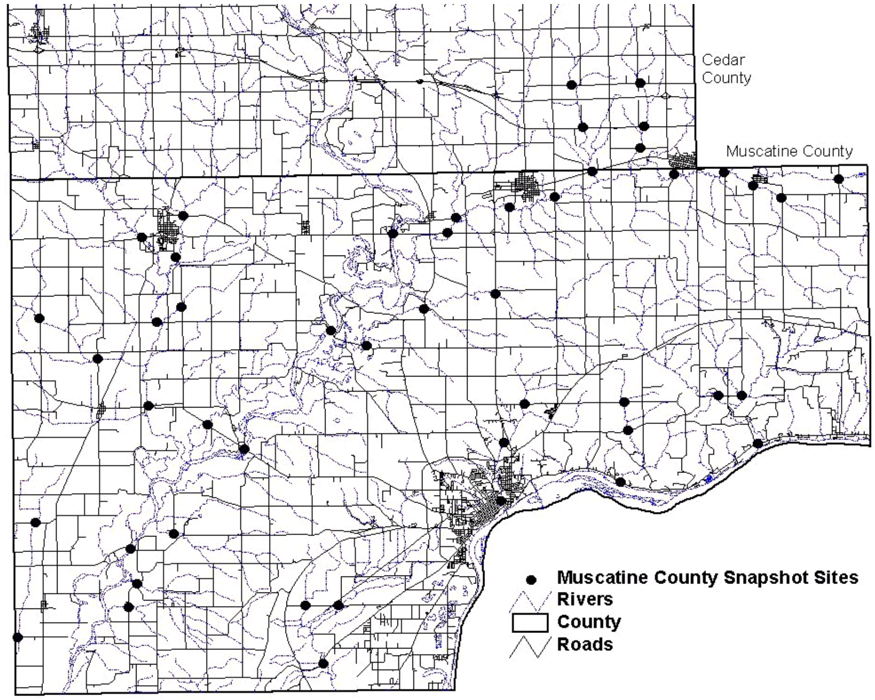


Figure 61. *Sites monitored as part of the Muscatine County Snapshot Sampling.*

Muscatine County Snapshot

Encouraged by the success of Scott County's Snapshot Sampling, Muscatine County embarked on organizing a snapshot sampling of its own. A total of 48 sites were identified, including 5 sites on stream segments in Cedar County, the county just north of Muscatine County, which eventually flow through Muscatine County (Figure 61). A subset of 14 sites was also sampled for pesticides. These sites were selected near the outlet of the larger subwatersheds in the county.

Table 9 summarizes the data from the sampling. All sites reported dissolved oxygen levels of 5 mg/L or higher. Transparency was high, with more than half of the sites having a transparency of 52 centimeters or higher. Elevated chloride levels were reported at some sites. Follow-up monitoring is being conducted at these sites to determine if these elevated levels were a one-time occurrence or whether the chloride levels remain high. Fecal coliform bacteria was >1,000 CFU/100 ml at several sites. Some of these sites are located in areas known to have failing septic systems. Total phosphorus concentrations ranged from 0.08 to 2.9 mg/L with some of the higher concentrations occurring at sites on the Cedar River. Atrazine and desethyl atrazine were the only

Table 9. *Muscatine County Snapshot Sampling results – October 15, 2002.*

	Unit	Method	# of samples	Min Value	Percentiles			Max Value	% Detection
					25th	50th	75th		
Water Temperature	degrees F	Thermometer - Field	48	44	50	50	52	62	
pH	pH units	IOWATER test strip	48	6.5	8	9	9	9	
Dissolved Oxygen	mg/L	IOWATER field kit	47	6	8	8	10	12	
Nitrite-N	mg/L	IOWATER test strip	48	0	0	0	0	2	
Nitrate-N	mg/L	IOWATER test strip	48	0	2	2	5	10	
Chloride	mg/L	IOWATER test strip	48	<24	<24	<24	24	533	
Transparency	centimeters	IOWATER transparency tube	48	2	28	52	60	60	
Total Phosphorus	mg/L	Lab Analysis	48	0.08	0.14	0.17	0.22	2.9	
Fecal Bacteria	CFU/100 ml	Lab Analysis	48	20	273	470	788	3400	
E. Coli Bacteria	CFU/100 ml	Lab Analysis	48	<100	<100	100	125	1100	
Atrazine	µg/L	Lab Analysis	14	0.08	0.14	0.17	0.22	0.29	93%
Desethyl Atrazine	µg/L	Lab Analysis	14	0.07	0.17	0.19	0.23	0.32	100%

CFU/100 ml = Colony Forming Units per 100 milliliters of water
The following pesticides were also analyzed at the 14 sites, however, no detections were reported: cyanazine, metolachlor, alachlor, metribuzin, butylate, trifluralin, acetochlor, desisopropyl atrazine, simazine, ametryn, EPTC, prometon, propachlor, propazine, and dimethenamid.

two pesticides detected in samples from Muscatine County, being present in 93% and 100% of the samples, respectively. These two pesticides were the most commonly detected pesticides for the Scott County, Whitebreast Creek Watershed, and Muscatine County snapshot samplings. Atrazine is the most frequently detected pesticide in Iowa streams statewide.

Summary

The snapshot samplings that occurred throughout Iowa in 2002 were successful because of the time and energy of local organizers in planning and coordinating the event. All of the organizers were successful in recruiting volunteers to participate in the sampling. Volunteers varied from IOWATER monitors to area school teachers and students to local and county officials to concerned residents in the county or watershed. For each snapshot, baseline data was collected that allows assessment of stream health throughout their respective county or watershed. In some cases, stream segments have been identified for follow-up monitoring. While results from each snapshot provide a picture in time of water quality, additional monitoring is planned by each group, and these future samplings will provide additional insight into water quality for these areas.

Acknowledgements

Key organizers for the Scott County sampling were Jennifer Anderson, Ed Askew, Carol Border, Heidi Carr, and Curtis Lundy; Angela Biggs, past coordinator for the Whitebreast Creek Watershed Project, orga-

nized the Whitebreast Creek Watershed Snapshot Sampling; and Matt McAndrew, coordinator for the Mud Creek Watershed Project in Mucatine County coordinated the Muscatine County Snapshot Sampling.

Results from the National Water Monitoring Day Snapshot: Iowa's Picture

On October 18, 2002, IOWATER monitors all over Iowa dipped test strips, transparency tubes, and thermometers into streams in an effort to assess the quality of streams across Iowa in the first statewide snapshot sampling event.

Iowa's statewide snapshot sampling was held in conjunction with National Water Monitoring Day. A total of 68 sites were sampled across Iowa. This paper summarizes results from Iowa's portion of the National Monitoring Day Snapshot, and compares the data to streams sampled statewide during October as part of Iowa's long-term stream network. Figures 62-70 and Table 10 provide results from the National Monitoring Day snapshot sampling.

National Water Monitoring Day Snapshot

October 18, 2002, marked the 30th anniversary of the passage of the Clean Water Act. To celebrate the event, volunteer monitors from across the U.S. were encouraged to test their waters as part of National Water Monitoring Day. The monitoring event was to provide a snapshot in time of water resources in the U.S. The event, the first of what is intended to be an annual event, was coordinated by America's Clean Water Foundation. Nationally, monitors were encouraged to measure water temperature, pH, dissolved oxygen, and water clarity/turbidity.

In Iowa, IOWATER monitors were encouraged to participate in National Water Monitoring Day by monitoring their regular sites between 10 am and 2 pm on October 18 and to complete any or all of the IOWATER field assessments. Data collected were then submitted to the IOWATER database. Results from the sampling were intended to provide a picture in time of water quality in Iowa (Note: The results in Table 10 include only data submitted to the IOWATER database and none of the data submitted to the National Water Monitoring Day website. Since not all IOWATER monitors were able to sample on Friday October 18, this summary includes data submitted to the IOWATER database for sites monitored from October 16 through October 20).

A total of 68 sites were monitored in 24 Iowa counties (Figure 62); three

Table 10. *IOWATER statewide snapshot sampling results for October 18, 2002.*

Parameter	Unit	# of samples	Min Value	Percentiles			Max Value
				25th	50th	75th	
Water Temperature	degrees F	63	29	45	48	51	59
pH	pH units	64	7	8	8	9	9
Dissolved Oxygen	mg/L	65	4	8	8	10	12
Nitrite-N	mg/L	64	0	0	0	0.15	1
Nitrate-N	mg/L	65	0	1	2	5	20
Chloride	mg/L	30	<25	<25	30	36	191
Transparency	centimeters	59	17	51	60	60	60*
Orthophosphorus	mg/L	63	0	0.1	0.2	0.3	5.0

Note: Three sites that were monitored were dry: two in Lucas County and one in Black Hawk County. * The maximum transparency reading that can be recorded using the transparency tube is 60 centimeters.

of the 68 stream sites monitored were dry. Two of the dry sites were in Lucas County in southern Iowa and have been dry since July 31, 2002 (note: since these two sites are relatively close to each other, the two sites appear as one site on the map); the other dry site was in Black Hawk County. Table 10 summarizes the results from the sampling. All samples were collected using standard IOWATER methods. For 10 sites, the October 18 sampling represented the first time these stream sites were sampled. All other sites have been monitored before, with some having been monitored 25 times or more.

pH levels from the IOWATER snapshot monitoring event varied from 7 to 9, with an average of 8 (Figure 63). The statewide stream network had pH values ranging from 7.2 to 8.9 for October 2002, with an average of 8.3. pH levels in Iowa streams typically fall within a very narrow range of 8.1 to 8.4. Of the 64 streams sampled as part of the snapshot sampling, 78% had a pH of 8 or 9.

Chloride was measured at 30 sites (Figure 64). The fewer number of chloride results reflects the difference in level of IOWATER training received by those who participated in the snapshot sampling. Chloride is an IOWATER Level 2 parameter, and only half of those who participated in the snapshot sampling have completed IOWATER Level 2 training. Chloride concentrations ranged from below detection (<25 mg/L) to 191 mg/L. The average chloride concentration was 30 mg/L, and is similar to chloride levels reported from the statewide stream network monitored during October 2002. Average chloride concentration for the statewide network for October 2002 was 23 mg/L, and concentrations ranged from 6.6 to 110 mg/L.

Three sites that were sampled as part of the IOWATER Monitoring Day Snapshot, a site in Black Hawk County, another in Dubuque County, and a third site in Johnson County, reported elevated chloride concentrations of 92, 150 and 191 mg/L, respectively. The site in Black

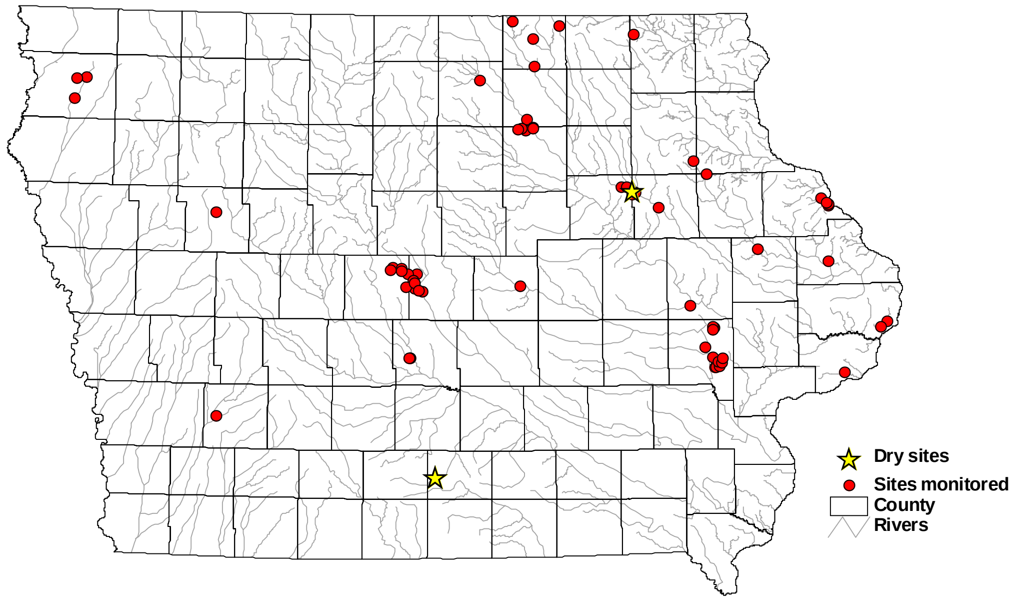


Figure 62. *Location of sites monitored.*

Hawk County has been sampled on a monthly basis for the past year, and the 92 mg/L is the highest chloride level reported for this site to date. The site in Dubuque County has reported chloride concentrations above 100 mg/L for the past year. The IOWATER monitor for this site has noted livestock adjacent to this stream site. The site in Johnson County is downstream of a municipal wastewater facility. This is the first time this site has been sampled, although this site has been used for IOWATER Level 2 workshops, and elevated chloride has been noted during those workshops. An elevated orthophosphorus value of 3 mg/L was also recorded at this site.

Orthophosphorus concentrations ranged from 0 to 5.0 mg/L (Figure 65). The average concentration was 0.2 mg/L. Six sites reported orthophosphorus concentrations of 1.0 mg/L or higher. These sites were located in Black Hawk, Johnson, Linn, Polk, and Sioux counties. The site in Black Hawk County had an orthophosphorus value of 1.0 mg/L, a concentration that has been recorded at this site previously. The orthophosphorus level in the Johnson County stream was 3.0 mg/L. This was the first time this site has been monitored. The site is located downstream of a municipal wastewater outfall, and also reported elevated chloride levels (191 mg/L). The Linn County site had a value of 5.0 mg/L, a level that has also been measured at this site before. Two sites in Polk County had an orthophosphorus concentration of 1.0 mg/L. Both sites also had a nitrate-N value of 5 mg/L. The site in Sioux County has been monitored seven times since August 2000. Each time the site has been sampled, orthophosphorus values have been greater

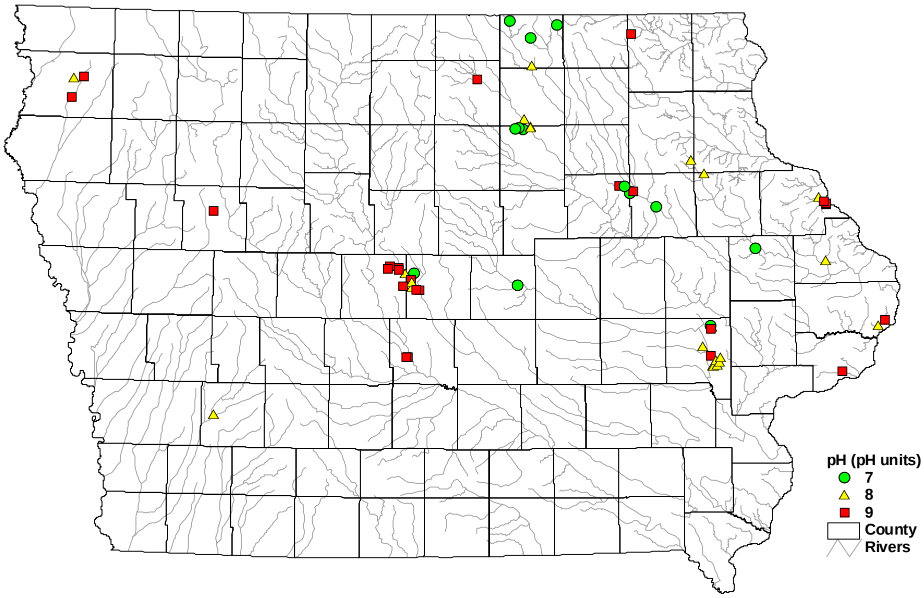


Figure 63. *pH results.*

than 1 mg/L. Nitrate-N concentrations tend to be elevated at this site also, ranging from 2-10 mg/L. This site receives runoff or discharge from a golf course, a municipal wastewater facility, and a meat packing plant facility. All of these facilities are located in the watershed above the site, and all are within four miles of the monitoring site.

The average orthophosphorus concentration reported from the statewide network of stream sites that were professionally monitored during October 2002 was 0.12 mg/L. Orthophosphorus concentrations ranged from below the detection limit of 0.05 mg/L to 1.2 mg/L, with the higher concentrations scattered throughout all of Iowa.

The average dissolved oxygen for the sites sampled was 8 mg/L (Figure 66); the lowest dissolved oxygen value was 4 mg/L, recorded at a site in Mitchell County. This was the first time that dissolved oxygen had been measured at this site. Another site in Johnson County had a reading of 5 mg/L. This site has been monitored for dissolved oxygen on 14 different occasions, and low dissolved oxygen concentrations have been recorded previously at this site. Eight sites reported a dissolved oxygen concentration of 6 mg/L. These sites were scattered throughout the northeast quarter of Iowa and included one site in Polk County. For most of these sites, previous monitoring has reported similarly low dissolved oxygen levels.

Average dissolved oxygen concentration for streams monitored professionally during October 2002 was 8.9 mg/L. Dissolved oxygen concen-

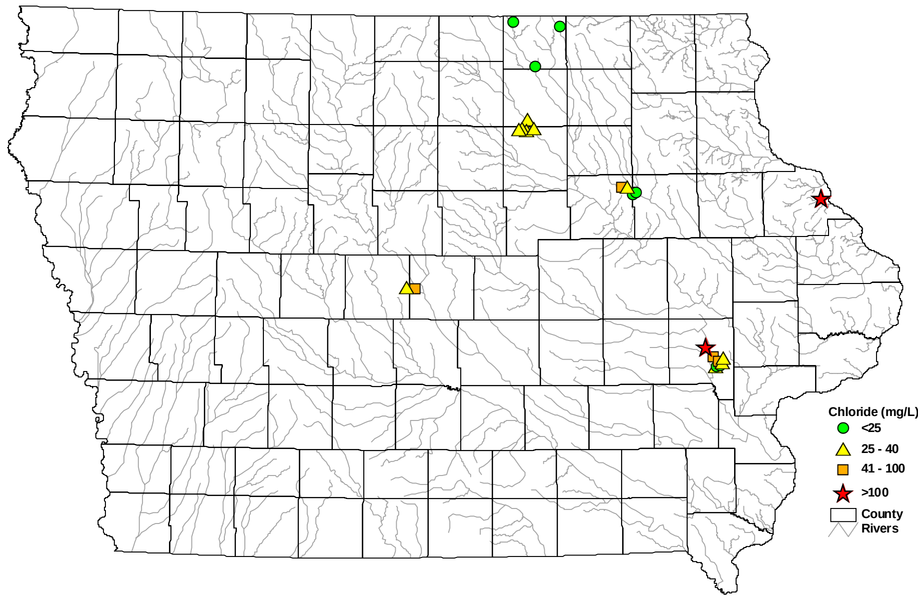


Figure 64. *Chloride results.*

trations ranged from 5.3 mg/L to 13.0 mg/L, with all sites reporting values greater than 5 mg/L. Sites with dissolved oxygen greater than 10 mg/L were primarily located in the northern one-third of Iowa.

Water temperatures from the IOWATER statewide snapshot ranged from 29 to 59 degrees Fahrenheit and the average was 48 degrees Fahrenheit (Figure 67). Sites that had lower water temperatures were located in the Squaw Creek Watershed near Ames in Story County.

The average temperature reported from the statewide network of stream sites that were professionally monitored during October 2002 was 60 degrees Fahrenheit. Water temperature ranged from 46 to 74 degrees Fahrenheit, with the warmer water temperatures primarily located in streams in the southern half of Iowa. The difference in temperatures between the IOWATER snapshot sampling and the statewide network of streams may be related to when each sampling occurred. The statewide network was sampled during the first two weeks of October, while the IOWATER sampling occurred the latter part of the third week in October. Statewide, air temperatures were above normal for the end of September and beginning of October, but quickly declined to below normal for most of October. October was the 5th coldest October on record based on 130 years of weather record in Iowa (http://www.agriculture.state.ia.us/climatology/weathersum1002.htm).

Nitrite-N concentrations ranged from 0 to 1 mg/L (Figure 68). The

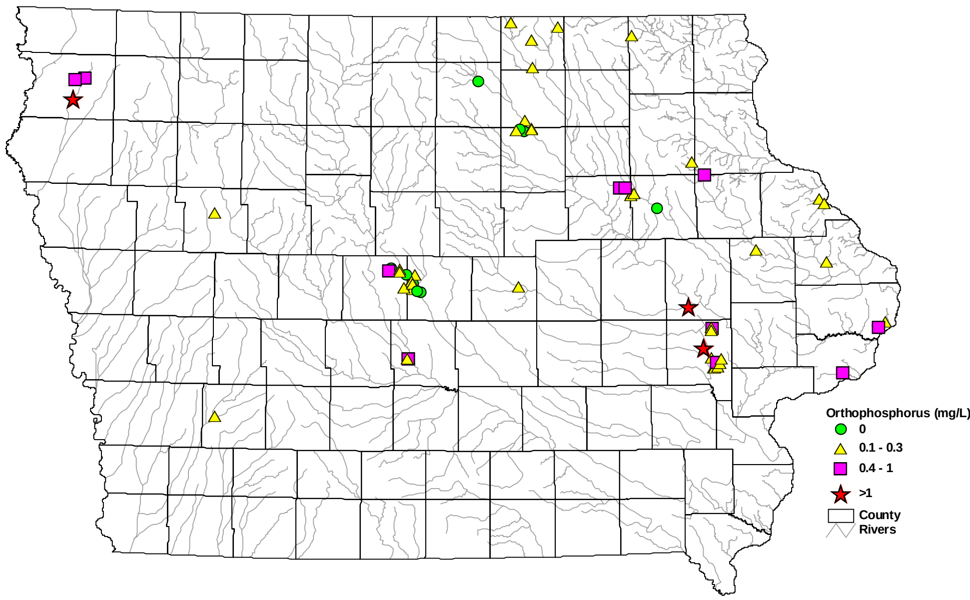


Figure 65. *Orthophosphorus results.*

majority of sites had 0 mg/L or a very low concentration. More than 65% of the sites had 0 mg/L; only 5% of the sites had nitrite-N greater than 0.15 mg/L. Of the sites with elevated nitrite-N concentrations, the site in Johnson County usually has low (0.15 to 0.30 mg/L), but detectable levels of nitrite-N. A site in Sac County had a nitrite-N concentration of 1 mg/L; very few samples have been collected at this site, and the 1 mg/L is the highest concentration to date.

Nitrate-N concentrations ranged from 0 to 20 mg/L, with an average of 2 mg/L (Figure 69). The highest reported nitrate-N concentration was 20 mg/L at a site in Cerro Gordo County near Mason City. This concentration was the highest nitrate-N value ever measured for this site. Three sites had nitrate-N concentrations of 10 mg/L: one in Sioux County in northwest Iowa; a site in Story County in central Iowa; and a site in Fayette County in northeast Iowa. Elevated nitrate-N has been reported previously for the site in Sioux County, whereas the nitrate-N result from the Fayette County site was the highest recorded to date for that site. The site in Story County has had elevated nitrate most of this year, with a high of 20 mg/L from July 2002.

The average nitrate-N concentration reported from a statewide network of stream sites that were professionally monitored during October 2002 was 3.4 mg/L (Note: For the professional network, nitrate is reported as nitrate+nitrite-N). Nitrate-N concentrations ranged from 0.1 to 17.0 mg/L, with the higher concentrations occurring in north-central Iowa.

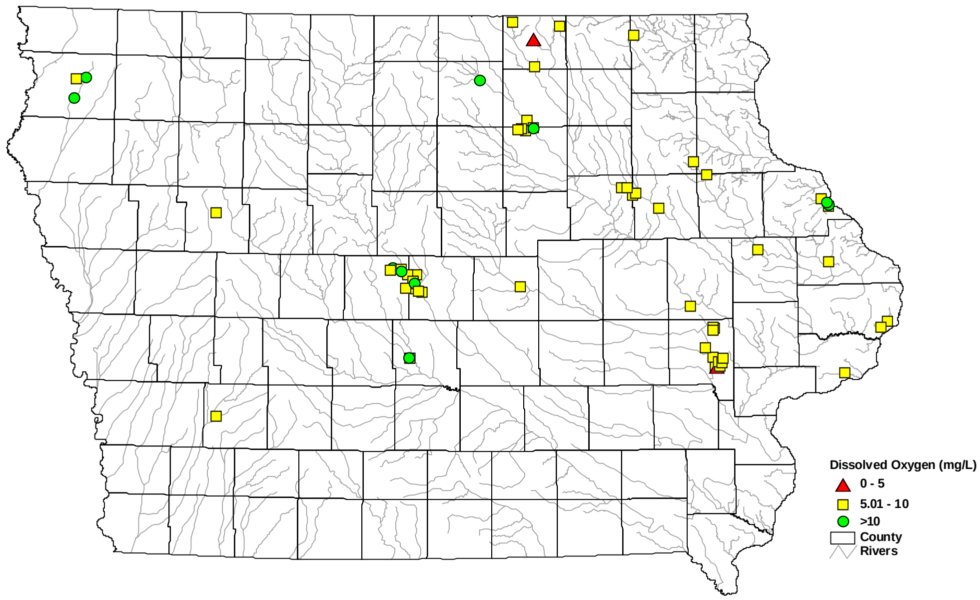


Figure 66. *Dissolved oxygen results.*

Transparency varied across Iowa. A cluster of sites monitored in the Squaw Creek Watershed near Ames in Story County and another group of sites in and around the Shell Rock River in Butler and Floyd counties all reported transparency values greater than 40 centimeters. Water transparency was high not only for these areas, but also for the majority of streams sampled, as 75% of the sites had a transparency of 50 centimeters or greater (Table 10; Figure 70). This was not unusual given the time of year and lack of rainfall prior to sampling. For one site in Butler County, the transparency reading of 51 centimeters was the highest reported for this site to date. The lowest transparency values were 17 and 19 centimeters for sites in Buchanan and Johnson counties, respectively. For the site in Butler County, 17 centimeters was one of the lower values reported for this site. For the site in Johnson County, past monitoring reported similar low transparency measurements.

Transparency is not measured as part of the statewide network of streams, rather, turbidity is used as an indicator of the amount of sediment in the stream. Turbidity values ranged from 1.2 to 690 Nephelometric Turbidity Units (NTU), and the average was 20 NTU (Note: The higher the turbidity reading, the more suspended material is in the water, compared to transparency where a lower transparency reading means that more suspended material is in the water). The higher turbidity values were recorded at streams in western Iowa and across the southern half of Iowa, while the lowest turbidity values were for streams in northeast Iowa.

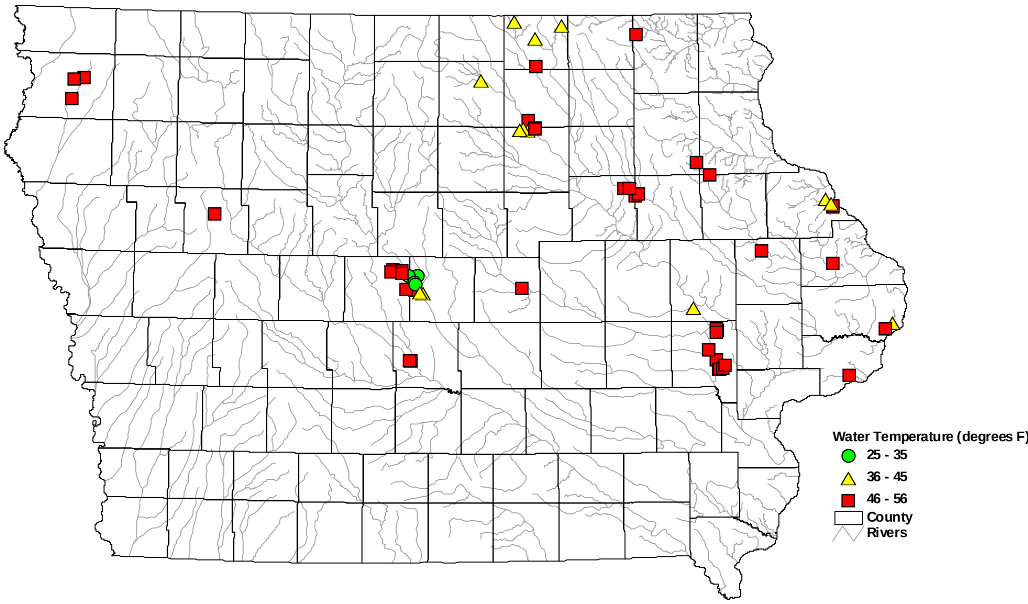


Figure 67. *Water temperature results.*

Future Statewide Snapshots

The IOWATER program gratefully acknowledges everyone who took time to monitor sites as part of the statewide snapshot sampling. We plan to build upon the first statewide snapshot sampling by coordinating a biannual statewide snapshot sampling in the spring and fall of every year.

Acknowledgements
Thanks to the following for their participation in the 2002 National Monitoring Day Snapshot Sampling and for submitting data to the IOWATER database: Jean Hagert Dow; Dieter Dellmann; James Heinz and Jefferson Junior High School students; Bruce Burroughs; Shirley Van Eschen; Andria Cossolotto and Atlantic High School students; Sam Hamilton-Poore; Kerry Krogh; Dana Lawrence; Cheri Hufford; Coleen Hughes and Dubuque Wahlert High School students; Charlie Winterwood; Richard Worm; Dave Carnahan and Table Mound Elementary School students; Lowell Dibble; John Black and Monticello High School Environmental Science students; Kim and Marsha Francisco; Bill Helgen; Irlanda Hoffman; Dale Adams; Debra Lyons and JMS 8th grade student; Charles Sayre and his wife; Curtis Lundy; Evan Degroot; Erwin Klass; Ken Shaw; Brian Vobr, Chad Kostohryz, and Brandon Riha of Crestwood High School Natural Resources class; Robert Basset; Gaylan and Lloyd Crim; Bell Tubbs; Karen and David Manning; Cheryl, Tyler, and Dillon Waskow; Lou Corones; Lisa Horsch

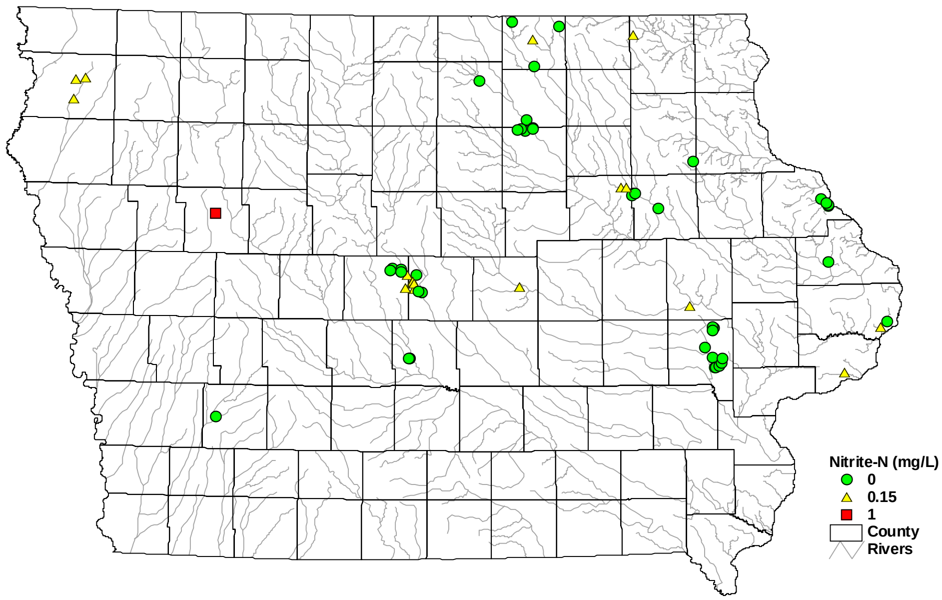


Figure 68. *Nitrite-N results.*

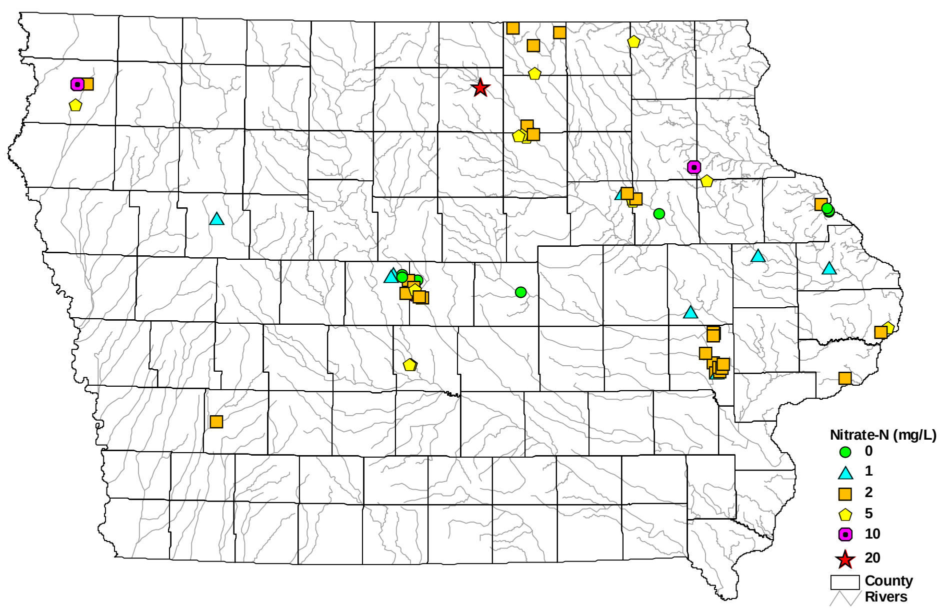


Figure 69. *Nitrate-N results.*

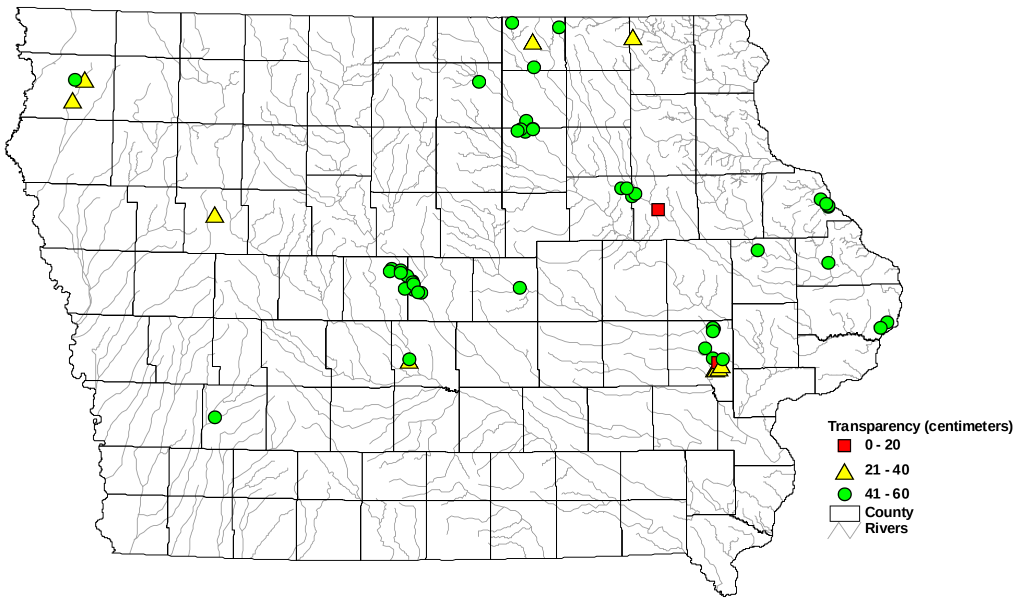


Figure 70. *Water transparency results.*

and Block 2 Science; Bill Schwarz and Prairie High School students; Eric Dralle, Tim Ott, Jen Linskey, Steph Chase, Kelly Chisholm; James Martin, Kristen L., Jason H., Kristen G; and Vicki Wilson.

Conducting a Snapshot Sampling Event

If you're interested in creating a water quality portfolio of a watershed in your area, it may be helpful to gather some snapshots of your own. Sure, the idea of conducting a snapshot sampling event might seem a little overwhelming at first, but if you can provide answers to the "Who," "What," "When," Where," "Why," and "How" questions, you're well on your way to success.

Who?

This may be one of the most important questions of all. After all, the "who" will include not only the planners and partners, but it also includes the target audience, or the people who you want to participate. The demographics and ideals of the "who" may be what guides the event and gives it direction. Therefore, the first step in developing a plan for the event is to develop a planning committee.

When the planning committee is in place their first objective is to establish the goal(s) for the monitoring event. This goal, or what it is you want to accomplish with this event, is made up of many objectives that will help to keep the event on track. The target audience, or people who you want to be involved in the snapshot sampling, may be identified within the goal. If they are not, they should be identified early so the event can be tailored to meet their needs. The next group of people who need to be identified and solicited are potential partners. Partners can help support and add credibility to the event.

What?

The “what” question will essentially be the snapshot sampling event itself, a culmination of the answers from the other questions.

When?

The date of the event should be decided upon early, so that it can be adequately publicized and marketed to potential partners and participants. As safety of everyone involved should be of utmost concern, a rain date should also be scheduled at this time.

Where?

Not only is the location of the snapshot sampling area important, but locations of individual monitoring sites are also necessary to include in the planning process. The goal of the event may strongly influence monitoring site locations. Furthermore, the specific parameters that will be sampled may also provide insight as to where monitoring sites are needed. Accessibility to sites is also a major concern, as we all want be make sure that we abide by the IOWATER Code of Ethics. Obtaining land owner permissions to monitor at certain sites may be a great way to expand participation diversity, build partnerships, and gain support. Site accessibility may not only be a question of land owner rights, however. Physical considerations such as terrain and feasibility must also be taken into consideration. When all potential monitoring sites have been identified, they should also be prioritized to maximize monitoring effectiveness, should participant numbers be low.

Why?

In other words, what do you want the event to accomplish? This question should be addressed in your goal(s).

How?

Finally, the nuts and bolts of the planning process – how will the plan come together? This is perhaps the most difficult and time-consuming question of them all. Things to decide on to answer this question may include: how the event will be publicized and marketed to the public, how the participants will be trained, how the data will be collected, how the information will be disseminated, and who will do what to get this all accomplished (division of labor).

When the answers to these questions have been answered, the stage will be set for a successful snapshot sampling event. The following "Steps to Snapshot Success" may help with the planning.

Steps to Snapshot Success:

1. Organize a planning committee – the decision makers that will plan the event.
2. Establish a goal, or goals, that have clearly defined objectives.
3. Identify the area or watershed in which the event will take place.
4. Identify the target audience – who you will influence or have participate.
5. Solicit and establish partnerships.
6. Select potential monitoring locations, obtain any necessary permissions, and pinpoint priority monitoring sites.
7. Develop a schedule of events – what will take place when?
8. Advertise, promote, and solicit the event through flyers, press releases, mailings, newsletters, and/or community meetings. Be sure to let participants know what will be required of them and what they should come prepared with.
9. Set up an orientation meeting where participants will be introduced to the event, understand the goals and objectives, and be trained on the monitoring methods they will be using. This could be done on the same day as the event, before the sampling takes place.
10. As safety is a major concern, participants should be made aware of possible dangers and sign a liability waiver, acknowledging that they are to be responsible for their own actions.
11. Assign monitoring locations to monitoring groups (for safety reasons, it's recommended that at least two people are assigned to a site) and distribute monitoring equipment to them.
12. Let the monitoring begin!
13. When all monitors have checked in and submitted their data, be sure to thank all participants and acknowledge the partnerships that were formed that helped make the event a success. Also, a free lunch doesn't hurt, either!
14. When the data is compiled, share it with all those involved, and anyone else who may be interested in the results. Feedback may be the most important step in the communication process.

ACKNOWLEDGEMENTS

Volunteer Awards 2001

IOWATER Volunteer of the Year – *Curtis Lundy*. Curtis began a monitoring program on Duck Creek in Davenport in 1998 with the Izaak Walton League's Save Our Stream program and has been with IOWATER since near its inception as an active proponent of water quality monitoring. He was largely responsible for the first onsite IOWATER Level 1 workshop in the state of Iowa, held in Davenport in April 2000. Curtis's enthusiasm and coalition-building skills helped form the Iowa Riverbend Streamkeepers, uniting teachers, state and federal government agencies, conservation groups, and the Riverboat Development Authority in a five-county area monitoring strategy.

IOWATER Professional of the Year – *Lora Friest*. Lora is the project coordinator for the Upper Iowa River Watershed Project (RC&D for NE IA Inc.) in northeast Iowa. Through her efforts, over 80 IOWATER sites and dozens of volunteers and professionals have been coordinated and focused on the 640-thousand acre watershed. Future activities could expand the coordinated activities to the Turkey and Yellow river watersheds. Lora has repeatedly helped IOWATER "push the limits" on procedures through advising and participation.

IOWATER Watershed Group/Organization of the Year–*Hawkeye Fly Fishing Association*. The Hawkeye Fly Fishing Association was founded in 1975 by a small group of Iowa anglers and conservationists dedicated to the promotion of fly fishing and conservation work to preserve Iowa's fly-fishing waters. Many of their members participated in early IOWATER "pilot" workshops in 1999 and have continued to actively support the program. The association is an active advocate for environmental policy, participating directly in the saving of French Creek and expressing support for strong water-quality standards through the Iowa Department of Natural Resources.

IOWATER Clipboard Award – *Donald Lund*. Donald has proven a tireless volunteer for many years within the Hawkeye Fly Fishing Association. His active pursuits of fly-fishing and dog tracking in addition to his love of the outdoors only enhance his contributions to the IOWATER database. Don spreads his work over eastern Iowa, including Dutton's Cave in Fayette County, Bigalk Creek in Howard County, Old Womans Creek and Phebe Creek in Johnson County, and Bigalk Creek and Bohemian Creek in Winneshiek County.

IOWATER Clipboard Award – *James Martin*. When it comes to energy, James is definitely a leader. He and cohort Brian Emerson have established a comprehensive Web organization, "Watersheds Unite," which provides information, resources and citizen networking for issues surrounding water quality in Iowa. In addition to his prolific volunteer water quality monitoring on Snyder Creek, James also is a valuable volunteer for the Johnson County Soil and Water Conservation District with his extensive Geographical Information System (GIS) expertise.

Volunteer Awards 2002

IOWATER Volunteer of the Year – *Dale Adams*. Professionally, Dale has been involved in water-quality issues since 1989 and recognizes the importance of monitoring. He is currently an environmental specialist with the Iowa Department of Agriculture. Dale's passion for water quality doesn't end when he leaves the office, however - he monitors several streams in Mitchell County, and actively recruits others to "get wet" through monitoring. Dale hopes to someday pass on his sites to other individuals or organizations that he recruits. He credits Don Lund, another IOWATER monitor, with getting him started on monitoring in Mitchell County, as Dale took over several sites that Don previously monitored. Dale saw it as an opportunity to put into practice what he learned in IOWATER. To date, he has successfully involved students and teachers from the St. Ansgar FFA and biology class, Osage High School, Riceville schools, and Marble Rock schools, as well as the Mitchell County Conservation Board.

IOWATER Professional of the Year – *Ellen Hartz*. Ellen is a science teacher with ECHO Alternative High School in Tiffin. She began water-quality monitoring and education efforts on her own for ECHO students in 1998, then connected these to IOWATER when the program began in 2000. Ellen teaches a 32-week course that meets four hours weekly and is devoted to water quality. She leads her students in monitoring sites in Iowa County. Ellen's students are literally "in the water" two to three hours each week. The students also learn how to be stewards of their environment and are involved with other natural resource activities such as attending Groundwater Association meetings, visiting the U.S. Geological Survey, independent studies, and presenting at the Iowa Children's Water Festival.

IOWATER Educator of the Year – *Ron Wilmot*. Ron has involved his students with water monitoring since 2000, when they sampled the Big Sioux River. He has also taken his class to Iowa Lakeside Lab for a field and research project, consisting of three days in the fall and three days in the spring, using high-tech equipment to conduct water monitoring. Under his direction, Ron's students have performed a water runoff study of the LeMars NRCS office property, which covers 38 square miles. Some other natural resource activities the students are involved with include a feasibility study for a wind turbine, a cricket frog study in Union County, South Dakota, a small mammal survey of Mt. Talbot in Stone State Park, elevation markers for Milford Site, and NatureMapping. Through Ron's leadership, his students have also prepared presentations for city councils, service groups, the local school board, state school board conventions, state and national teacher workshops and conferences, and four presentations at the school per year.

IOWATER Watershed Group/Organization of the Year – ***Squaw Creek Watershed Council.*** The Squaw Creek Watershed Council came into being in March 2001. Its mission is "to provide leadership in protecting and improving the environmental health of Squaw Creek Watershed by facilitating cooperative involvement of urban and rural residents in raising public awareness and promoting educational programs and targeted actions." The council has accomplished this through their monitoring of Squaw Creek and its tributaries, and they have increased public awareness of watershed issues through town meetings and watershed boundary signs. In addition, the council has sponsored local presentations on the CREP Program, septic systems, and flood plain management and coordinated field trips to a remnant marsh in the watershed and the Bear Creek riparian buffer project. The group has actively promoted IOWATER monitoring by its members and throughout the watershed. More than 170 sets of IOWATER volunteer data from 49 sites in the watershed have been recorded. The council has also participated in work days at a prairie restoration site along Squaw Creek and in removing trash from Squaw Creek and its tributaries.

IOWATER VOLUNTEERS 2000-2002 (by county)

* Monitor who has registered a site, but not submitted data
**** Monitor who has registered a site and submitted data**
Thank you – your data contributions made this report possible!

Adair
Merlyn Brown
Tonnie Martin

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Mike Olive
Chelsey Pafford
Deb Roberts
Kyle Shipley
Steve Sonntag
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Note: If any information is incorrect, please contact IOWATER.

IOWATER VOLUNTEER MONITORING DIRECTORY

The following is a list of all water monitoring groups that have registered with the IOWATER program. To obtain contact information about these programs, please visit the IOWATER website (**www.iowater.net**) or contact IOWATER staff.

Clear Creek
  Boone and Story Counties
Cooperative Lakes Area Monitoring Project
  Dickinson and Palo Alto Counties
Des Moines Area Community College, Environmental Science Lab
  Polk County
Eagle Grove High School Science Class
  Wright County
ECO Monitors
  Lucas County
Five Island Lake Restoration Project
  Palo Alto County
Help Our World
  Polk County
Hilton Creek Watershed
  Iowa County
Iowa Riverbend Streamkeepers
  Cedar, Jackson, Muscatine, Louisa, Scott, and Clinton Counties
Kuemper Monitoring Team
  Carroll County
Larkers
  Butler County
Lake Delhi Restoration Project
  Delaware County
Linn County Izaak Walton League- Save Our Streams
  Linn County
Maquoketa Watershed
  Delaware County
Marion High School Field Biology and Composition
  Linn County
Macbride Watershed Project
  Johnson County
Mineral Creek Water Quality Project
  Jones and Jackson Counties
Minnehaha Creek Watershed Project
  Grundy County
North Cedar Stream Study
  Cedar County
Pine Creek
  Winneshiek County

Pioneer Watershed Watch
Lyon County
Rathbun Lake Water Quality Project
Wayne and Clarke Counties
Snyder Creek Watershed
Johnson County
Squaw Creek Watershed Council
Hamilton, Boone, and Story Counties
Wapsipinicon Volunteer Water Monitors
Black Hawk, Buchanan, and Bremer Counties
Water Monitoring Team, First Presbyterian Church
Cerro Gordo County
Wright County Water Quality Education Program
Wright County

IOWATER Partners

Area Education Agencies
Conservation Districts of Iowa
Hawkeye Fly Fishing Association
Iowa Association of Naturalists
Iowa Association of Resource Conservation & Development Areas
Iowa Community Colleges
Iowa Conservation Education Council
Iowa Department of Agriculture & Land Stewardship
Iowa Department of Natural Resources
Iowa Division of Izaak Walton League
Iowa Drainage District Association
Iowa Environmental Council
Iowa Farm Bureau Federation
Iowa Pork Producers
Iowa Poultry Association
Iowa Student Environmental Coalition
Iowa State University 4H Extension
Iowa Water Pollution Control Agency
Iowa Watersheds
Trees Forever
United States Natural Resource Conservation Service
University Hygienic Laboratory (University of Iowa)

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